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LOCAL ANESTHESIA AND THE MASTOID OPERATION.

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The recent epidemic of influenza in the military hospitals of the country has taught us many valuable technical and therapeutic lessons. The constant presence of atmospheric infection, the frequency of active pneumonia, have presented many risks in major operations under protracted anesthesia during this period. This proved to be emphatically the case in a series of acute mastoid empyemas following in the wake of "flu" infection.

To overcome the serious objections to the use of general anesthesia, practically all of the operative work in the Section on Head Surgery at Camp Dodge Base Hospital has been accomplished under local anesthetics and the experiences gleaned from this practice in so large a series of cases leads us to discuss this question of local anesthesia as a possible regular and routine procedure.

I desire to report herewith a series of twenty acute mastoidectomies successfully performed by me under local anesthesia in this service. By successful performance I mean a minimum of pain, a minimum of risk to the patient's health, and 100 per cent recovery.

The principle on which this form of anesthesia is based is that of diffuse and constant pressure on the nerve distribution in the skin and secular tissues as originally developed by Schleich. The Schleich anesthesia is a deep and superficial subcutaneous injection of fluid

along or throughout the selected area of operation and depends almost entirely on diffuse pressure on the nerve end-organs, and not on the character or strength of anesthetic used for the same. Anesthesia can be produced by plain sterile water as well as by admixture of cocain, eucain, novocain or other known drugs. In most of the cases of mastoid complication following acute suppurative otitis media during the flu epidemic, the soft tissues about the mastoid area were infiltrated and edematous beyond the usual intensity. This marked infiltration offered an additional obstacle to the effectiveness of a local anesthesia by subcutaneous method, but even this difficulty was overcome by increasing the quantity of solution used, firmer pressure in making the injection and carrying the injecting needle classically subcutaneous for the superficial injections and under the periosteum for the deep injections. By this procedure I was able to maintain an area of uniform pressure between the surface tissues and the periosteum and thereby control all the intermediate nerve elements.

TECHNIQUE.

For these injections I use a 10 cc. all-metal syringe and all-metal plunger and a needle two and one-half inches long and of fair lumen. The most satisfactory anesthetizing solution is one-half of one per cent novocain in distilled water, to which may be added one to ten thousand solution of adrenalin in equal parts. This solution, as well as the cocain solution, is rendered thoroughly sterile by boiling in small Erlenmeyer flasks on a Bunsen burner or spirit lamp shortly before operation.

To avoid mistakes in the use of one solution for another it is a general order throughout the hospital to lightly color all cocain solutions with methylene blue, and all novocain solutions intended for tissue injection with tincture Persionis. With a standard hypodermic syringe and needle (either glass or metal) I first make my subcutaneous injection, beginning with the mastoid area in the zygomatic line and working toward the tip. The infiltration includes a belt of about one inch in width and extends from the insertion line of the auricle backwards and parallel to it. The deep injections are then undertaken with the heavier metal syringe and needle, beginning at the same point on the zygomatic line and covering the distance to the mastoid tip at about four points. For the deep injections the larger needle is plunged in a slanting direction downwards until the point engages the mastoid bone. By a slight rotary motion of the hand the needle is worked between the periost

and the bone and 5 or 6 cc. of fluid forced into this area. The same technique is carried out at the other three selected points from the zygomatic line to the mastoid tip and, in the injection at the tip of the slant of the needle is directed upward toward the head, instead of downward toward the neck. These two injections, deep and superficial, effect an area of anesthesia throughout the field of operation. The classical incision is now made parallel with the insertion line of the auricle and cutting in one sweep from the zygomatic line to the tip, and to the bone.

Before elevating the periosteum forward and backwards, and applying retractors, a suitable pledget of cotton, soaked in 10 per cent solution of sterile cocain, is placed in the wound for four or five minutes. The one difficult area to anesthetize during the mastoid operation is the posterior wall of the auditory canal and the middle ear cavity proper. To accomplish this satisfactorily the large injection needle is passed to the depth of the mastoid incision just made between the periost and the bone and carried to the fundus of the canal as far as possible. Two or three cc. of solution are delivered at this point. If the operation is undertaken simply for mastoid cell exenteration and drainage of the antrum this one injection into the depth of the canal wall will suffice. For the radical operation, further injections are necessary to insure anesthesia of the tympanic membrane and tympanic cavity. This completes the technique for anesthesia and the operation is conducted in the usual manner. In the twenty cases here reported, my observations included the completeness of the anesthesia, the conduct of the patient, the character of the invasion, the intensity of the process, the size of the wound, and such other data as may help to throw light on this form of technique.

DETAILED CLINICAL RECORD OF TWENTY CASES OF MASTOIDECTOMY UNDER LOCAL ANESTHESIA.

Case I. H. E. W., male, farmer, age 19, Ohio; in service two months; date of admission, Sept. 27, 1918. Temp. 100.6°, pulse 84, resp. 24, headache, epistaxis, cough, pharyngitis, conjunctivitis—diagnosis influenza-ambulatory. Developed measles with profuse eruption Oct. 7; broncho-pneumonia Oct. 18.

Oct. 26. Measles cured; convalescing from pneumonia.

Oct. 27. Acute otitis media sup. dextra and within 24 hrs. much sensitiveness over right mastoid area, skin glazed and edematous; considerable viscid pus discharging from right ear; acute, constant earache.

Oct. 29. Mastoidectomy under local anesthesia; 35 cc. ½ per cent novocain. Operation painless. Cortex thin; wide area of necrosis and granulation; antrum large; much pus. Laboratory exam. of pus from mastoid reports strept. hemolyt. present. Usual mastoid after-treatment. Patient made uneventful recovery; discharged from ward Dec. 31.

Case II. A. B. W., male, farmer, age 23, Iowa; in service five months; date of admission, Nov. 30, 1918. Temp. 103, pulse 120, resp. 24, face flushed, headache, sore throat, profuse eruptions, cough, photophabia.

While on guard duty caught cold; Nov. 30 measles developed; moderate broncho-pneumonia found Dec. 12. Acute sup. otitis media sinistra with hemo-purulent discharge began Dec. 19. Pain and tenderness over left mastoid developed Dec. 25; mastoid operation, Dec. 28. 40 cc. ½ per cent novocain used; injection quite difficult, due to extent and hardness of induration area. Surprised to find, under these circumstances, the completeness of the anesthesia; much pressure used in making the injections. Laboratory exam. from pus in mastoid reports strept. hemolyt. present.

Jan. 15. Wound healed completely; patient discharged.

Case III. H. McC. W., male, age, 30. Date of admission, Oct. 5, with usual symptoms of influenza, accentuated by pain in right ear, later in left ear.

Right M. T. bulging, intensely red, with multiple blebs. Blebs punctured and careful culture from contents showed presence of strept. hemolyt.

Membrana tympani incised 24 hours later with free discharge of pus. Similar conditions developed in left ear.

On Oct. 18 tenderness developed over left mastoid with edema, checking up of pus discharge from ear, rise in temperature, and slight chill. Mastoid exenteration under ½ per cent novocain local anesthesia; 35 cc. injected with considerable difficulty, owing to intense induration. Anesthesia complete. Bacteriological examination reports presence of strept. hemolyt.

In this case a slight edema and moderate amount of slough of wound edge was noticeable during first few dressings. This gradually subsided without unusual treatment. Patient made uneventful recovery.

Case IV. H. McC. (same patient as Case II). Mastoid empyema, right. Mastoid exenteration undertaken with local anesthesia, ½ per cent novocain, about 30 cc. injected. Anesthesia complete. On remov-

ing cortex, bone found very necrotic and all cells full of semi-fluid, sanguineous pus. Bacteriological examination reports presence of strept. hemolyt., healing rapidly. Patient discharged January 6.

Case V. C. J. W., male, age 22. Date of admission, Nov. 9. Convalescing from measles.

Nov. 10. Acute sup. otitis media, right.

Nov. 12. Acute bronchitis, coarse rales heard throughout right lung; frequent cough; no physical signs of pneumonia.

Nov. 14. Chest findings negative. Acute laryngitis; cough persists.

Nov. 16. Sore throat, pain in right ear.

Nov. 18. Ear discharging freely.

Nov. 25. Pain in ear continues. External auditory meatus swells; tenderness over mastoid.

Dec. 15. Mastoid tenderness increasing.

Dec. 21. Mastoid exenteration; operation under local anesthesia of cocaine-novocain.

In this case edema infiltration of wound areas was very intense, and much pressure was necessary to deliver the contents of the anesthetizing syringe at selected points. Fifty cc. of cocaine-novocain were injected. Special stress was laid on the introduction of the injecting needle between the periost and mastoid bone.

Mastoid and antrum contained much bloody pus and granulation tissue. Strept. hemolyt. found from curetted tissue in mastoid.

Wound healed promptly and satisfactorily. Swelling in external auditory canal disappeared within 24 hours after infiltration anesthesia. No slough in wound area; no pain at operation, no shock.

Case VI. J. I. Ind., male, age 29. Admitted from "flu" pneumonia ward, convalescing from severe attack of bilateral pneumonia.

Nov. 9. Earache and mastoid tenderness. Patient gives history of previous acute sup. otitis media in both ears about nine years ago; this condition cleared up in two or three weeks and has had no trouble with ears since.

Nov. 11. Mastoid pain aggravated; intense general cephalgia, temp. 100.6°; some vertigo.

Nov. 12. Mastoid operation. Exenteration of left antrum and cells under cocaine-novocain anesthesia.

Infiltration quantity, 60 cc. Injection limited to mastoid area and not introduced in external auditory canal.

Patient complained of no pain during operation, but describes extreme discomfort in sensation of mallet and chisel.

Report on curetted mass indicates presence of strept. hemolyt.

In this case there seemed to be some operative shock during ten or twelve hours following operation. After that convalescence was rapid and simple.

Case VII. E. R. W., male, age 27. Contracted measles Nov. 18. Discharged from infectious ward on Nov. 27. Developed ear ache Dec. 1. Admitted to Head Surgery, Dec. 3. Ear discharging freely; mastoid tenderness and infiltration persisted until Dec. 20, when mastoid exenteration under local anesthesia was performed. Radiogram also corroborated presence of pus in mastoid antrum and cells. Did not localize cloudiness or shadows in tip.

Infiltration anesthesia with 50 cc. cocaine-novocain. Superficial injections accompanied by some pain. No complaint of tip injections. After infiltration was complete no further complaint from patient.

Bacteriologically strept. hemolyt. and staph. albus were found. Pus in antrum and upper cells; blood and slight granulations in tip cells. Entire cell labyrinth was exenterated.

Patient walked from the operating table to roller chair. Wound healed promptly and completely.

Case VIII. C. W. W., female, A.N.C., age 29. Admitted Oct. 26, sore throat, ear ache. Ear discharging. Temp. 101°. General depression, some cough.

On inspection M. T. found diffusely injected and red, with multiple hemorrhagic blebs. Free incision made to facilitate better drainage. Discharge of bloody pus continued for a period of several weeks. Temp. fluctuating between 97.8 and 102.5.

Nov. 10. Moderate mitral regurgitation noted. No appetite; no food assimilation; bowels require constant attention; patient assuming intense general irritability and nervousness. Superior posterior canal sagging.

Dec. 27. Right mastoid cells and antrum exenterated under local anesthesia. In this case the extreme general nervous condition of the patient and her distrust of any surgical attention seriously handicapped the local anesthesia. The resistance and restlessness demonstrated at the time of operation must be laregly attributed, in this case, to the mental attitude and fear on the part of the patient rather than to any ineffectiveness of the anesthetizing injections.

Patient recovered quickly, wound healing rather more rapidly than usual, and this also may be noted, as there was quite marked disturbance of circulation during the active period of her illness.

Bacteriologically, strept. hemolyt. found in mastoid wound.

Case IX. L. K. W., male, age 22. Bilateral lobular pneumonia following "flu." Admitted to Head Surgery Dept. Oct. 2. Left drum membrane ruptured spontaneously following ear ache of three or four hours; discharge of blood and pus from ear followed.

Oct. 21. Paracentesis was required as discharge was arrested, and pain and fever continued.

Nov. 25. Extreme mastoid tenderness; pain in ear, patient slightly delirious.

Nov. 27. Left mastoid operated. Cells exenterated under local anesthesia. 50 cc. cocaine-novocain used. Anesthesia complete; patient walked from operating table to roller chair. Uneventful recovery.

Case X. W. P. N., male, age 27. Patient admitted from "flu" pneumonia ward. Convalescent from bilateral lobular pneumonia. Acute sup. O. M., right, began during "flu" pneumonia attack, and was treated by consultant regularly during this period. After admission to this Dept. ear symptoms became aggravated. Tenderness over mastoid developed; discharge became scant; rise in temperature daily of from one to two degrees.

Nov. 29. Operation of right mastoid; exenteration by local anesthesia. 40 cc. of cocaine-novocain used; infiltration was prompt; anesthesia complete, even to the extent of probing from the antrum to the cavum tymp.

In this case there was some slight slough of the wound edge, but this could hardly be attributable to the infiltration process, as less quantity than usual of anesthesia fluid was used, and there was but little induration over the mastoid area and not much pressure of injecting syringe required. Patient healed promptly.

Case XI. A. W. W., male, age 23. Influenza, admitted Oct. 7; temp. 100.2; pharyngitis and tonsilitis, head ache, dizzy, cough.

Oct. 12. Confluent lobular pneumonia.

Nov. 4. Throat red, right fossae swollen, pain in right ear, tenderness over mastoid.

Nov. 6. Purulent discharge from right ear; tenderness over mastoid less; tonsils less red, but still somewhat edematous.

Nov. 11. Severe pain in mastoid region, discharge from middle ear still continues; ear ache fairly constant. Admitted to Head Surgery section.

Nov. 17. Operation; exenteration of right mastoid cells, local anesthesia, cocaine-novocain; 50 cc. of infiltration fluid used. Anesthesia complete, patient complained of no pain. Walked from table to wheel chair. Sitting up six hours after operation; ambulatory

three days after operation. Complete bacteriological confirmation of strept. hemolyt. from pus in mastoid taken at operation.

Case XII. C. O. W., male, age 22. Patient admitted to hospital on stretcher; severe "flu," all characteristic symptoms, left lobular pneumonia, lower lobe. Two weeks after admission developed acute otitis media, hemorrhagic, left; paracentesis; free sero-hemopurulent discharge.

In this case strept. hemolyt. was determined by bacteriological examination of pus discharged from ear. Characteristic mastoid symptoms developed and patient was operated Dec. 1. Edema and induration over mastoid was marked, and anesthesia was accomplished with 60 cc. of cocaine-novocain solution only after considerable pressure of syringe and by using much care in getting under periost. Anesthesia complete; patient walked from operating table to chair. Recovery uneventful. Bacteriological confirmation of strept. hemolyt. from curetted mastoid tissue.

Case XIII. A. S. W., male, age 23. Admitted to "flu" ward with characteristic "flu" symptoms accentuated by intense ear ache. Inspection of right M. T. reveals multiple hemorrhagic blebs. These were incised; bacteriological culture of serum from blebs diagnosed as strept. hemolyt. Moderate ear ache continued for several days; M. T. bulging on fourth day and paracentesis performed. Thirty-six hours later mastoid tender to touch, edematous; and posterior superior canal wall sagging. Pain on pressure over mastoid accentuated at tip.

Nov. 7. Mastoidectomy by local anesthesia; 50 cc. cocaine-novocain used; anesthesia complete; cells exenterated to tip; outer table at tip found necrosed; typical Bezold mastoiditis. This was corroborated by radiogram before operation. Bacteriological findings of pus from mastoid indicate strept. hemolyt. Patient ambulatory throughout. Recovery uneventful.

Case XIV. E. O. W., male, age 21. Acute otitis media suppurativa preceded "flu" infection about two weeks. Patient was operated in 1904 for mastoid empyema of left ear.

Convalescent from "flu" within five or six days, but pain and discharge in ear accentuated. Mastoid tenderness and edema developed; mastoidectomy performed Dec. 25. Exenteration of cells under local anesthesia, cocaine-novocain in 50 cc. quantity used as infiltration fluid. Anesthesia complete, patient ambulatory throughout. Bacteriological findings—strept. hemolyt. and staph. albus.

Case XV. S. P. W., male, age 28. Admitted with usual "flu" symptoms; developed lobular pneumonia, bilateral; three weeks

after convalescence from pneumonia mastoid area became suddenly edematous and tender; fever 101.6; intense head ache and some vertigo.

In this case there was no discharge from the ear, and no change in color, plane, or surface appearance in M. T., and no evidence of fluid in tympanic cavity.

Dec. 2. Mastoidectomy under local anesthesia, cocaine-novocain 50 cc. Patient walked in and out of the operating room; anesthesia complete; recovery complete. Bacteriological findings of granulation tissue, blood, and slight quantity of pus found in mastoid cells reported strept. hemalyt.

Case XVI. T. L. W., female, age 25. Apparent recovery from "flu" and pneumonia, but patient still weak and prostrated. Pulse thready and slight intermittent heart. This case was one of blood transfusion.

Right mastoid became involved three days after an acute otitis media following apparent coryza.

Patient taken to operating room on roller stretcher. Forty cc. of cocaine-novocain injected. Anesthesia ideal; considerable pus and blood found in antrum; mastoid cells small and entire mastoid area quite sclerotic. Bacteriological findings, strept. hemolyt.; recovery uneventful.

Case XVII. J. C. W., male, age 25. Admitted as stretcher case with severe "flu," of which profuse epistaxis was a predominant symptom. Culture of blood from nose at time of hemorrhage showed presence of strept. hemolyt. Acute otitis media with hemorrhagic blebs and acute mastoiditis developed within three days.

Mastoidectomy under local anesthesia; 40 cc. of cocaine-novocain solution used; bone found quite sclerotic, small antrum; comparatively little pus. Bacteriological findings from curetted tissue, strept. hemolyt. Anesthesia complete; recovery complete.

Case XVIII. L. M. W., male, age 27. Convalescent from measles and pneumonia. Suppurative otitis media, left, persisting for about four weeks. Pain in mastoid region developed gradually but persistently.

Mastoid operation under local anesthesia, 50 cc. of cocaine-novocain used, anesthesia quite satisfactory; cell labyrinth filled with granulation tissue and small quantity of pus, and was exenterated to tip. Slight edema about edges of wound for several days; this subsided uneventfully; patient made complete recovery.

Case XIX. J. McC. W., male, age 7. Admitted from civilian quarters following convalescence from bilateral lobular pneumonia.

Typical acute mastoid empyema with usual symptoms; 40 cc. of cocaine-novocain injected; anesthesia complete. This was an exemplary patient. Felt simply the discomfort of the malleting but no pain. Strept. hemolyt. found in pus of exenterated mastoid area. Recovery complete.

Case XX. J. F. W., male, age 24. This patient had a severe lymph-adenitis on the right side of neck following "flu" and lobular pneumonia. Neck gland seemed to gradually clear up, but mastoid infiltration ensued, and the radiogram showed definite haziness in mastoid antrum and cells adjoining antrum. No discharge from ear noted at any time, and no evidence of involvement of middle ear cavity by usual methods of inspection and examination.

Mastoid exenteration done under local anesthesia, 50 cc. cocaine-novocain used; exenteration performed as completely as possible down to cells in tip. Strept. hemolyt. corroborated in bacteriological findings of tissue from operated field; some bacteriological diagnosis had been made from broken down cervical glands which had been incised, curetted, and drained about three weeks previously. Patient made satisfactory recovery.

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Earache. H. B. BLACKWELL, *New York Med. Jour.*, June 21, 1919.

Earache may be divided into the four following groups: (1) Inflammation behind tympanic membrane, usually preceded by inflammation of upper air passages; (2) inflammation of the soft parts of external auditory canal (external otitis or furunculosis); (3) otalgia, the pain being referred from teeth, nose or throat; (4) mechanical, occurring mainly in children and infants with enlarged tonsils and adenoids. The pain is nearly always nocturnal, recurring several nights in succession.

CONSENSUAL REACTION IN THE HEARING CENTERS.

Dr. John F. Callahan, Brockton, Mass.

In Weber's test in unilateral obstructive deafness, the vibrating tuning fork when placed in contact with teeth or forehead is heard only in the obstructed ear. I have seen at different times in hospital and private practice, doctors lose all patience with patients because the patient would not admit hearing the fork in the obstructed ear. I will admit if the patient followed the rules of the game as laid down by eminent otologists, that he should always hear in the obstructed ear when the vibrating tuning fork is in contact with teeth or forehead.

Following my law of the hearing centers such a patient should lateralize but the law of the hearing centers applies only to the individual whose numerous pathways in the brain are in a normal condition.

Law: When two sounds which have similar properties, except intensity, are transmitted one to each ear, both impulses will pass to the hearing center on that side where the intensity is the greater; and there will be a summation of the two stimuli. We are, therefore, conscious of hearing the sound louder than if the sound of lesser intensity did not reach the ear, and also if both sounds reach each ear with equal degrees of intensity. The increase due to the summation is not an arithmetical addition but follows Weber's law.

The consensual reaction of the hearing centers in the lateralization and summation of two sounds, one of which goes to each ear and which vary only in their intensity, places one more test in the hands of the psychologist and neurologist in testing the mode of action or reaction of specialized nerve centers and aids in localizing intracranial lesions.

The neurologist in testing consensual reaction of the pupils can now pass to the ear, where we can give a similar demonstration in testing impulses that pass from one side of the brain to the other side by well recognized tracts. Any individual who cannot lateralize as per the law of the hearing centers has surely some process along the route taken by the auditory fibres that rise from the accessory nucleus in the pons, as most of the fibres arising in this nucleus pass to the other side.

Theoretically it would be possible for an individual to lateralize the less intense sound that reached the right ear, where he would be

unable to lateralize if the less intense of two sounds reached the left ear. The lesion in such a case would be along the crossed fibres of the left auditory nerve.

When an individual is unable to lateralize as in Weber's test, we should at once question ourselves as to the possibility of a block somewhere in the cross fibres that connect the auditory nerve on one side with the hearing center on the other side.

When a vibrating tuning fork is in contact with the forehead or teeth in an individual with two normal ears, he is conscious of hearing the fork in both ears, or as is most likely the case, he will tell you that he hears it in the center of his head. Obstruct the external auditory canal on one side and the sound of the fork is lateralized to that side. That the vibrations from the tuning fork reached both cochlea with equal degrees of intensity we will admit; but when we obstruct the external auditory canal on one side, the fork is heard with greater intensity on that side due to excluding extraneous sounds. Then following my laws on the hearing centers we get a lateralization of the sounds and a consequent summation in the hearing center that is on the side of that cochlea that appreciates the sound of greater intensity. The vibrations pass to both cochlea but the impulse from the cochlea that appreciates the sound of lesser intensity does not pass to the hearing center on that side, but crosses over to the hearing center on the opposite side and is superposed on the impulse that reaches the hearing center from the cochlea on that side.

LATERALIZATION AND SUMMATION OF SOUNDS.

*My hearing test to detect malingering beautifully demonstrates how we lateralize two sounds which are similar in all their properties except intensity. The following test demonstrates the lateralization and subsequent summation of two sounds which differ only in intensity. In this test I use a rubber tube with a 3/8-inch hole and 3/32-inch wall. The normal ear can hear a whisper through this size tube at about 35 feet.

Take two tubes of this size each ten feet long. Place a metal connection about seven inches long at about the center of each tube. The metal connections fit snugly inside the tubing so that we can extend the tube by slipping the rubber tube down the metal tube. Connect each tube to a funnel which is placed over each ear. The other ends of the tubes are connected with a mouthpiece, which consists of one ether cone, covered by tin at the smaller end, and from which tubular extensions enter the cone.

*Boston Medical and Surgical Journal, August 15, and September 28, 1910.

With the tubes of equal length the patient tells us that he hears the whisper in both ears or he may tell you that he hears the whisper in the center of the head. Slip the metal connection on the tube that goes to the right ear so that this tube will be two, five or even seven inches longer than the tube that goes to the left ear. What happens?

The patient will tell us that he only hears the whisper now in the left ear (which is connected with the source of the sound by the shorter tube) and that he hears the whisper louder than when he heard it in both ears or in the center of his head.

Take two tubes each ten feet long. Connect them with a funnel which is placed over each ear. Both tubes are connected with a mouthpiece which consists of an ether cone covered by tin at the smaller end, and from which two tubular extensions enter the cone. With the two tubes of equal length the patient is conscious of hearing the whispered voice in both ears, or he may tell you that he hears one voice in the center of his head.

Make the tube going to the right ear one, two, or three inches shorter than the one going to the left ear. Shortening the rubber tube is accomplished by slipping it further on the tubular extensions of the mouthpiece or the funnel. Start counting (whisper) into the mouthpiece, say from one to twenty-five. When we have whispered five or six numbers, disconnect the tube going to the left ear which is the longest tube—rememebring that the patient is only conscious of hearing the numbers counted in the right ear, which is connected with the shorter tube. What happens when the longer tube is disconnected from the left ear? The patient will tell you that he does not hear the count as loudly as he did when both ears were connected. We keep right on counting, the tube having been again connected with the left ear. What happens? One or two things may happen.

First, the patient may not hear anything in the left ear, and if he does not, he will tell you that he hears the whisper louder in the right ear.

Or, the patient may hear the whisper in both ears, but the sound will only remain in the left ear, while three or four numbers are being counted, when suddenly he will have a sensation of the sound leaving the left ear. It then becomes lateralized in the right ear, and he also tells us that he hears the whisper louder than at the time he heard it in both ears.

This test demonstrates that when we are conscious of hearing a sound only in one ear, when both ears are connected with the source of the sound, that the vibrations do not reach the hearing center on the side that receives the sound of lesser intensity. They evidently pass directly from the cochlea on that side to nerve tracts to the hearing center on the opposite side.

The sound in the right ear is not increased in the same proportions as to the amount of the sound that passes from the left ear by the tracts to the right hearing center. The increase in sound in the right hearing center when the impulse of greater intensity reaches that side plus the intensity of the weaker impulse that reaches the left ear and passes to the right hearing center, follows Weber's law.

For how surely the hearing centers lateralize two similar sounds of inequal intensity is demonstrated as in following test:

Two ten-foot tubes connected as in previous test.

Whisper into mouthpiece and patient will tell you that he hears the whisper in both ears. Shorten the tube going to the right ear and he will hear the whisper only in the right ear. Some individuals lateralize easier than others. In some cases we must shorten the tube three or four inches and even more.

But it shows the power that we have of lateralizing, for in the test we use tubes ten feet long that the patient can hear a whisper through at 35 feet in either ear, and yet by making the ten-foot tube one or two inches shorter going to one ear, the patient is unable to hear the whisper in the ten-foot tube and will only hear it in the tube that is nine feet eleven inches.

The simplest test that I know of to test the consensual reaction of the hearing centers consists of seven feet of rubber tubing with a ⅜-inch hole and 3/32-inch wall.

Place a funnel over each ear and attach each end of the rubber tubing to funnels. Place a vibrating tuning fork against rubber tube about two feet from right ear. He will, if the tracts are normal, only hear the sound in the right ear, although we know that the left ear is within the limits of hearing of the fork as the normal ear can hear this fork at 35 feet on the same tube. As soon as the patient admits hearing the sound only in the right ear, disconnect the tube from left ear by lifting the funnel away from that ear. Our patient will then tell us that he does not hear the sound as loudly in the right ear as he did when we were connected with both ears.

This test will show us the condition of the crossed tracts of the left auditory nerve. To test the crossed tracts of the right auditory nerve, we place the vibrating fork on tube about two feet from left ear.

TESTS TO SHOW HOW THE TWO HEARING CENTERS ACT AT THE SAME TIME.

This test shows that when two sounds which are similar in all their properties and one of which goes to each ear, the sound that reaches the left cochlea passes to the left hearing center, and the sound that goes to the right cochlea passes to the right hearing center. The test also shows that when there is a difference in the intensity of the sounds going to each ear, we lateralize to that side where the intensity is the greater.

The summation of the stimuli reaching both cochleae, in the hearing center on the same side that receives the stimulus of greater intensity, is shown by cutting off the sound of lesser intensity. If there is no summation in this test in the right side when the sound of greater intensity passes to that side, we can assume that the cross fibres of the left auditory nerve are involved in a process. If there is no summation of the sound that is heard on the left side when we disconnect and again connect the tube that goes from dictaphone No. 2 to the right ear, we would expect that the cross fibres of the right auditory nerve was likewise involved. Previous to the test two records have been made by one person on a dictograph. Into each record is read different sentences.

Connected to the dictaphone is a rubber tube which is connected by a T to two short rubber tubes that are inserted into each meatus, when the machine is in use.

Two funnels each with two outlets are placed one opposite each ear. Two tubes ten feet long are connected to dictaphone No. 1 at the ear pieces. One of the ten-foot tubes is attached to one of the outlets on the funnel at the right ear. The other tube is attached to one of the funnels at left ear.

Dictaphone No. 2 is likewise attached by two ten-foot tubes, one going to the second outlet of funnel over right ear and the other ten-foot tube going to the second outlet which is placed over the left ear.

Both dictaphones are started. What happens? If each ear were connected with a single dictaphone we can easily hear what the dictograph has recorded on the record.

In this case we have the right ear connected with both dictaphones, and the left ear likewise connected. The spoken words from dictaphones No. 1 and No. 2 pass to the right hearing center and also to the left hearing center. We cannot understand a word that is sent by the two dictaphones. Nothing but a babble of unintelligible noises like one might hear from a gallery while several people were talking all together on the floor below.

We shorten the tube that passes from dictaphone No. 1 to right ear about three inches. Following my law of the hearing centers we get the following results. The tube passing from dictaphone No. 1 to right ear is now shorter than the tube going from dictaphone No. 1 to left ear; therefore, we will hear dictaphone No. 1 loudest in the right ear and the sound from the tube going to the right ear will pass to the right hearing center as will also the sound from the tube that passes through the tube from dictaphone No. 1 to left ear, and according to my law we are only conscious of hearing the sound on that side that receives the sound of greater intensity. We are at once conscious of hearing the voice sounds from dictaphone No. 1 in right ear.

Now that the sounds from dictaphone No. 1 are heard plainly in right ear they must pass only to the right hearing center. The left hearing center, not receiving any sound impulses from dictaphone No. 1, is only connected with dictaphone No. 2, the sound of which passes to that of the left hearing center. We therefore hear the sound from dictaphone No. 1 in the right ear and from dictaphone No. 2 in left ear; although as we know that the sound from dictaphone No. 1 passes to both ears, as does the sound from dictaphone No. 2.

A further proof that the sound passes from dictaphone No. 2 to left hearing center via the right ear is demonstrated by disconnecting the tube that passes from dictaphone No. 2 to right ear. We do not hear the sound as loud in the left ear as when the both tubes are connected with dictaphone No. 2 and both ears.

Similarly, if we disconnect the tube that passes from dictaphone No. 1 to left ear, we do not hear the sound as loud in the right ear.

The increase in the sound if we again connect the tube and the fact that the increase is noted in the ear on the opposite side from where the tube is attached is sufficient to show that it passes from one ear over to the hearing center on the opposite side, there to be united with the sound that reaches that hearing center from the ear on the same side, as we are always hearing as in the test, dictaphone No. 1 in the right ear and dictaphone No. 2 in the left ear.

In the first part of the test I usually have considerable trouble in getting all the four tubes and connections exactly alike so that the conduction of the sounds will be of equal intensity when it reaches the ear from all of them, for if the intensity is greater in any one of the tubes when it reaches the ear, we will get a lateralization of the sounds.

To cause the sounds from the two dictaphones to be lateralized is especially easy, as it is considerably easier to get all not alike in their conductivity than all exactly alike. The several individuals who tried the above test all could hear, and repeat what they heard in each dictaphone through the same size tube that we used in the test at 20 feet. In the test I used a similar tube in ten-foot lengths.

LATERALIZING SOUNDS.

We know that the vibrations from a tuning fork that is placed against the right mastoid reaches the cochlea on the left side with sufficient degree of intensity that we would be conscious of hearing them in left ear, if the hearing apparatus on the right side were destroyed, but while the hearing on the right side is present, we get a lateralization and summation at once on that side following the laws of the hearing centers.

That the vibrations reach the cochlea on the left side when the watch or fork is held in contact with the right mastoid is demonstrated in the following test. This test also further proves that the increase in intensity when the external auditory canal is obstructed is due to shutting off extraneous sounds. It also proves that increasing the amount of extraneous sounds will cause a lateralization to the opposite ear, just as obstructing the external auditory canal by lessening the amount of outside noises to that ear will cause the sound to be lateralized to the obstructed ear.

Obstruct the external auditory canal of the left ear with an electric noise apparatus. (Muffle the electric noise apparatus. We do not need the excess noise that it produces). Place a vibrating tuning fork (256 C-1) on left mastoid, first starting the noise apparatus. We are conscious of hearing the tuning fork in the right ear, and the intensity is increased if we now obstruct the external auditory meatus on that side. Here we have two sounds, the source of each is nearest the left ear.

We hear the louder of these two sounds in the left ear, and not in the right. We hear the other sound in the opposite ear, and we are not conscious of hearing it in the left ear that is nearest the source. That the vibrations from the noise apparatus reaches the cochlea of the right ear we will all admit, but we are not conscious of hearing that sound in the right ear, as the sound reaches the left ear with greater intensity than it does the right ear. Following the law of the hearing centers, we are only conscious of hearing this sound on that side where the intensity is the greater, as the impulse that reaches each cochlea passes then to the hearing center on that side which receives the vibrations of greater intensity.

Why do we hear the tuning fork in the right ear and not in the left?

The sound of the noise apparatus in the left ear drowns out the vibrations of the tuning fork on that side, similarly as we are unable to hear a whisper in a noisy room that we can easily hear in a quiet room. Therefore, we cannot hear the tuning fork in the left ear. The vibrations of the tuning fork that reach the cochlea of the right ear, is what we hear in that ear as they pass to the hearing center on that side, plus vibrations that reach the cochlea on the left side, but the fact that we hear the vibration of greater intensity in the right ear causes the sound of the tuning fork to be lateralized on that side.

The reason that the intensity is not as great in the left ear as it is in the right ear, even though the source of the sound from the tuning fork is nearer the left ear, is but an example of every-day life that we all experience, where we are unable to hear a watch tick, or a whisper, or even a loud voice. Although we know that we are within the hearing distance of these sounds, yet they are entirely lost to us due to the intensity of the other sounds.

The appreciation of the intensity of a sound varies inversely with the intensity of other sounds of greater intensity. In fact the perception of the weaker sound will be lost entirely to that ear if the difference between the two sounds reaches a certain limit.

When the vibrating 256 C-1 tuning fork is against the left mastoid, and the muffled noise apparatus against the left ear, the vibrations from the tuning fork that reach the left cochlea are not of sufficient intensity to effect an impulse in the cochlea that will reach the hearing center on that side and be registered there.

The conditions in the right cochlea and right hearing center are different. All the impulses from the noise apparatus reach both cochleae, but according to the law of the hearing centers they are only registered in the left hearing center.

The right hearing center receiving no impulses due to the noise apparatus, readily receives and registers the impulses set up in the right cochlea and we are therefore conscious of hearing the tuning fork on the right side. Shut off the noise apparatus at the left ear while the fork is in contact with the left mastoid and the sound of the tuning fork will pass from the right ear over to the left ear.

When a vibrating fork is held against the teeth of an individual with normal hearing and the right ear is obstructed with the finger in the external auditory canal, the intensity of the sound is increased and is also lateralized to the obstructed ear. We will all admit that the vibrations reach each cochlea. What happens to the vibration that reached the cochlea on the left side?

Instead of passing to the hearing center on the left, they pass to the hearing center on the right via nerve tracts. This is according

to my law of the hearing centers and is the cause of the summation.

That the increased sound in an obstructed ear, that is when we obstruct the canal with the finger, is not due to increased resonance is shown by the fact that we get an equal increase when we place a large funnel over the ear or a receptacle with a capacity of several gallons over the external ear. The increase in sound is not due to preventing the passage of undulations outward from the ear when the vibrating body is brought in contact with the cranial bones, for with the ossicles of the membrana absent there is even less obstruction to outgoing vibration than when they are present, but even then we get the same increase in sound as when the external canal of a normal ear is obstructed with the finger. In fact Jankan's test in obstructive deafness external to the stapes, the tympanic structures being a state of increased tension, will allow of rather more vibrations to pass out.

The appreciation of the sound tuning fork in the right ear and the noise in the left ear demonstrate the precision with which the hearing centers work. The only reason that we do not appreciate the sound of the tuning fork in the left ear is not because the noise from the noise apparatus drowns out the sound so that is is not possible for its appreciation in the left ear, but the noise from the noise apparatus lowers the appreciation of the sound of the fork in the left ear. The noise from the noise apparatus dominates the left ear and its hearing center, so that there is greater appreciation of the sound of the tuning fork in the right ear and accordingly the sound is only heard on the side where the appreciation is the greater.

To demonstrate that the noise from the noise apparatus does not drown out the vibrations of the tuning fork in the left ear, we place the noise apparatus in contact with the left mastoid and the vibrating 256 tuning fork at the entrance of the left auditory canal, we hear the tuning fork and the noise apparatus both in the left ear. The reason that we do not hear the tuning fork now in the right ear as we did when the position of the sound and noise producers were reversed, is that we are hearing the sound from the tuning fork by air conduction, and its vibrations only reach the left cochlea and do not reach the right cochlea as they did in the previous test by bone conduction.

In the first test the vibrations from the fork and from the noise apparatus reach both cochlea, whereas in the second test the vibrations from the tuning fork do not reach the cochlea of the right ear, a fact that was demonstrated by Morse in an individual who had an unilateral affection of the hearing center on one side causing

total deafness on that side. Morse's patient was unable to hear the tuning fork when the fork was one inch from ear on affected side, showing as in my test that there was no vibration reaching the cochlea on the opposite side, either by bone or air conduction.

Place a vibrating C-1 256 tuning fork one inch from right ear and a vibrating C-2 512 tuning fork against the right mastoid. Then obstruct the left external auditory canal with the finger. The sound from the C-2 512 fork is heard in the left ear and the C-1 256 fork in the right ear.

Place a C-1 256 and a C-2 512 vibrating fork against left mastoid. Obstruct the external auditory canal of right ear, and the sounds from both forks are heard in right ear.

Place a vibrating C-1 256 tuning fork in contact with the right mastoid; obstruct the left external auditory canal; we hear the sound of the fork in the left ear.

Obstruct the left external auditory canal with a vibrating noise apparatus. Place a vibrating tuning fork in contact with the teeth. The sound of the tuning fork is plainly heard in the right ear when the noise apparatus is vibrating, and in the left ear when the noise apparatus is not vibrating, but merely obstructing the left external auditory canal.

Obstruct the external auditory canal of each ear with the flat surface of an electric noise apparatus. Place a vibrating tuning fork in contact with the left mastoid; we are conscious of hearing the tuning fork only in the left ear. Now start the noise apparatus that is obstructing the left ear with the vibrating tuning fork in contact with the left mastoid. We now hear the fork in the right ear. The reason for using two noise apparatuses is that I wished to produce an equal amount of obstruction to both ears, showing that though the tuning fork is nearer the left ear, we can only hear it in the right ear.

In the test where we attempt to lateralize the tuning fork to the right ear when the vibrating fork is in contact with the left mastoid, and the noise apparatus vibrating and obstructing the left external auditory canal, I find that we will not lateralize to the opposite ear if the noise apparatus makes too much noise. In other words, the intensity of the sound from the tuning fork and the noise from the noise apparatus must be of a certain relative intensity to cause the tuning fork to be lateralized to the opposite ear.

The noise from the noise apparatus must be of a just sufficient intensity so that there will be a greater degree of appreciation of the sound from the tuning fork in the cochlea that is on the opposite side to the noise apparatus.

231 Main Street.

AN UNUSUAL MALIGNANT TUMOR OF THE PHARYNX.*

Dr. C. M. Clark, Rochester, Minn.

Malignancy of the upper air passages, according to the observations of men who have written on the subject, is closely associated with acute and chronic inflammatory conditions. Many patients who have had a so-called catarrhal affection for years, frequently exaggerated by acute infections of the mucosa, have usually been subjected to direct local treatment. It has often been our experience that the patient attributes his condition to some previous trouble, frequently remote but so conclusive that undoubtedly there must be a direct connection between the two.

In the upper respiratory tracts, especially around the larynx, a secondary infection sometimes develops through the ulceration of an early malignant growth. This is often observed in cases of epithelioma, when the neck, either one or both sides, becomes involved by a low grade chronic infection, manifested by a slowly developing, hard external swelling, which takes on the characteristics of a phlegmon and breaks down or has to be drained.

Recently a patient has been under observation on Doctor New's service, whose condition differed in some respects from the usual picture seen in the upper air passages. After a careful search in the literature extending back over a period of ten years I have been unable to find the description of a similar case. It is reported herewith:

The patient (Case 259107), male, age 45, farmer, presented himself for examination February 3, 1919, complaining of pain in the throat and difficulty in swallowing and talking. Two weeks before the patient had had a sudden attack of coughing and gagging followed immediately by hoarseness which lasted five days, then the speech began to improve but the coughing continued and the throat remained painful. After seven days his condition gradually became worse. At the time of examination he could swallow liquids only; he talked in a whisper.

The Wassermann test, urine, blood, and x-rays of the chest, etc., were negative. The left cervical region presented a large thickening which extended forward over the larynx with

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all the symptoms of an acute inflammatory swelling. By direct examination the pharynx appeared slightly injected; otherwise it was normal. The indirect examination showed the left side of the larynx and the hypopharynx to be swollen and edematous. The swelling extended evenly across the midline and partially involved the right side of the hypopharynx and the larynx. No ulcerations or areas simulating malignancy were found; the intrinsic structures of the larynx were not visible. The left arytenoid was swollen and only slightly moveable, the right arytenoid was swollen but motion was not interfered with. Respiration was obstructed and tracheotomy seemed inevitable, but after the use of hot packs and inhalations for three days the breathing improved slightly and the swelling became localized over the right cervical region. February 6, 1919, the phlegmon was drained and six ounces of pus were evacuated. The sinus was kept open for two weeks with iodoform gauze to allow healing from below, and hot packs were applied externally to facilitate drainage. February 10, 1919, the patient was again examined by the indirect method. The edema and swelling had subsided noticeably and a flat ulcerated area, three-fourths of an inch in diameter, was seen along the left lateral aspect of the hypopharynx and extending into the left pyriform fossa. Microscopic examination of the tissues showed squamous-cell epithelioma.

The examination and observation of this patient seemed to show that the malignant condition must have been present for several weeks or months without causing symptoms and that a secondary acute infection metastasized to the deeper structures through the early lesion on the surface epithelium. It may be that cases of this nature are more common than our experience leads us to believe since we do not see them during the intermediary stage when the malignant features are completely masked by those due to acute infections, but we see them during the early or late stages when malignant features predominate.

Without a definite and correct diagnosis in such cases which can be obtained only by microscopic examination of the tissue, the patient will seldom be given the advantage of the most improved methods of treatment.

REPORT OF A CASE OF AN OTITIC ABSCESS OF THE BRAIN.*

DR. JOHN GUTTMANN, New York.

Owing to the greater attention that is being given nowadays to chronic suppurations of the middle ear, intracranial complications are not very common. The occurrence of a brain abscess as a result of such complications is comparatively rare, and warrants a more or less detailed report.

S. M., 35 years old, consulted me for the first time on July 14, 1918, complaining of severe headaches and vomiting, which his family physician ascribed to a gastritis. Having had an ear discharge for the last 16 years, the patient himself suspected that his headaches might bear some relationship to the discharging ear.

Inspection revealed the presence of foul smelling pus in the ear with soft red granulations protruding from the upper and posterior wall of the tympanic cavity. Hearing V-1 h-o. The caloric test showed a functionating labyrinth. Evidently the granulations were not attached to the labyrinthine wall.

In order to facilitate drainage, I removed some of the granulations; there was no difficulty in doing this and the patient did not experience any pain during their removal. This was followed by great relief, which lasted for 3 days; on the fourth day he returned to my office with a temperature of 103°, severe headache and drowsiness.

He was immediately sent to the hospital, where I performed a radical mastoidectomy. The cortex of the mastoid was found sclerosed, no cells being practically encountered. The antrum and tympanic cavity were filled with foul-smelling cholesteatomatous masses; the tegmen antri seemed perforated with drops of pus oozing through the opening; the opening was widened and two ounces of very offensive-smelling pus, evidently under pressure, gushed out from the enlarged opening.

The drum beneath was covered with reddish granulations; the radical operation was then completed and the wound closed.

The following day the temperature dropped to 99°, the sensorium became clearer and the drowsiness considerably diminished. The next day, temperature, 99°, sensorium not as clear as the day

*Read before the Section on Otology, New York Academy of Medicine, May 9, 1919.

before. Babinski, Kernig and Brudzinsky, present. The cerebrospinal fluid was under great pressure and microscopically showed evidences of meningitis; the exact bacterium could not be determined culturally. Diagnosis: Meningitis; this was corroborated by Dr. E. D. Friedman.

On July 22, the temperature rose to 100.1°; sensorium clouded. July 23, the wound was reopened, and the dura was found bulging but not pulsating. Thereupon I decided to explore the brain, and accordingly explored the lower gyrus of the temporal lobe. About two ounces of "cadaverous" smelling pus was evacuated from a cavity, which was the size of a small orange. Decomposed brain matter was evacuated with the pus. During this, the patient stopped breathing, and artificial respiration had to be resorted to. After a considerable period, respiration was re-established and the patient was removed from the operating table, but six hours later the temperature rose to 105, and he died.

Some of the interesting features of this case are:

1. At the onset of the disease the patient was treated for gastritis, the vomiting and headache being attributed to disease of the stomach.

2. The course of the affection was probably the following: Cholesteatomatous masses broke through the tegmen tympani or antri, forming a chronic brain abscess. This was quiescent, and having produced no symptoms, the patient did not seek relief until the abscess caused meningeal irritation.

3. The removal of polyps from the ear even when they are not attached to the labyrinthine capsule may flare up a "slumbering meningitis."

4. The stoppage of breathing during the operation was due to temporary interference with the circulation in the medulla, most probably on account of the sudden change in the intracranial pressure, after the evacuation of the pus from the brain abscess.

60 St. Mark's Place.

FOCAL DISEASE INVOLVING THE MAXILLARY ANTRUM, THE TEETH AND THE EYE.*

DR. L. D. BROSE, Evansville, Ind.

This paper is only concerned with focal disease of the maxillary antrum, the teeth and the eye and their etiological relationship. The antrum is more frequently diseased than the other para nasal cells due to the close relationship of its floor with the roots of the bicuspid and molar teeth. At one time it was thought that dental infection was responsible for 75 per cent. of antral disease. This, through our more modern methods of examination, has been found erroneous, and according to Skillern the teeth are responsible for something like 20 per cent. Rhinologists hold that most infections occur intranasally after rhinitis and such infectious diseases as influenza, pneumonia, measles, scarlet fever, etc. Other causes to be enumerated are disease in the frontal and ethmoidal cells, chronic otorrhea, traumatism, foreign bodies, syphilis, tuberculosis, new growths, osteomyelitis and dental infection. The periosteal lining of the antrum has a loose connective tissue layer, separating it from the overlying mucous covering so that severe attacks of coryza give rise to much swelling and edema and since the ostium of the antrum is located above its floor at a point very unfavorable for gravity drainage, stagnation early takes place within the antral cavity, intensifying the inflammatory reaction. Bacteriologically, we find streptococci, especially virulent the viridins, staphylococci, pneumococci, colon bacillus and influenza bacillus. An interesting case of tumor involvement of the antrum is the following: Louise G., 14 years of age, with physical development that of a young woman of 19, consulted me March 9, 1919, because of a swelling of the left side of the face below the eye. It has been of slow growth and at times painful, but without nasal discharge. The teeth are sound. To palpation the swelling is firm, non-painful and without crepitation. The left nostril is encroached upon, due to bulging inward of its outer wall. Transillumination with lamp in the mouth shows the left antrum darker than the right. Radiogram disclosed marked difference in the two sinuses with the roots of the two left bicuspid teeth obliquely displaced. March 18, 1919, patient ad-

*Read to the Vanderburgh Co. Medical Society in Dental Symposium, June 17, 1919.

mitted to the Hayden Hospital, and under general anaesthesia an incision made beginning well above the left molar teeth and carried forward to the central incisor teeth. The periosteum was raised and pushed upwards with raspatory, disclosing the entire bony facial wall above the alveolar process absorbed with here and there traces of a thin scale of bone that offered no resistance to the knife. The entire left maxillary antrum was occupied by a dense tumor formation which, beginning at the inner side and under the nasal process of the superior maxilla, was with difficulty gradually enucleated from the antral cavity, leaving the posterior wall softened in places. Hemorrhage was not severe and the operation was finished by inserting a light packing of iodoform gauze. Cooling lotions and a mouth wash of boric acid were used to control the swelling. Dr. S. Z. Herbert, the hospital pathologist, made the following report: Growth irregular and somewhat nodular form, of cartilaginous consistency. Section: no great vascularity but irregularly arranged mass of connective tissue fibres closely packed, in which cartilaginous areas are seen with definite cartilaginous structure. Diagnosis: Fibro cartilaginous tumor. It is my opinion that the tumor is of embryonal tissue origin. Of cystic tumors we find two varieties. The retention mucous membrane cyst that results after chronic inflammation of the lining membrane or after repeated acute attacks and the dentigerous cyst connected with disturbances in the development of the teeth. Zuckerkandle, who has given much time to the investigation of dentigerous cyst, makes two divisions of them. The one, an internal variety, since it grows within the antral cavity, originating through inflammatory changes at the root of a diseased tooth. The other develops without the antral cavity and within the alveolar bony tissue; through gradual growth, however, it encroaches more and more upon the antrum, remaining separated from it, however, by the shell of bony tissue originally overlying the attic of the diseased tooth. The lining of the dentigerous cyst is made up of variable layers of proliferated pavement epithelial cells, derivitive of embrynol tooth forming cells. Dental disease is seen as tooth caries, the ordinary ulcerated tooth, as pyorrhea alveolaris and as abscess at the apex of the tooth, the result of pulp infection. Pyorrhea begins usually with reddening of the margins of the gums, which become tender and bleed easily. The inflammation slowly extends along the roots of the teeth, separating the dental membrane, producing pus pockets with destruction of the alveolus. Apical abscess gives rise to gum boils, circumscribed

osteomyelitis with granuloma formation and fistulous opening through the lingual or labial plate of bone. So long ago as October, 1894, I have recognized the relation of focal dental disease to disease of the eye and called attention to the importance of an examination of the teeth before undertaking a delicate eye operation in a paper published in the Ophthalmic Record, October, 1895, citing a case of double cataract extraction made in St. Mary's Hospital on Jane W., age 47 years. The first eye was operated successfully October 16, 1894, and healed without incident. The second eye was operated October 27, 1894, and progressed without complication until the eighth day when the eye became painful and red, iritis. The pain continued with remissions and relief was not to be had until a dentist was called in on the 17th day and extracted eight carious teeth. Thereafter the eye healed and good vision was secured. More recently I have had another forcible illustration of the relation of oral sepsis to eye disease in the person of J. E., 80 years old, who, on April 2, 1917, underwent in the Hayden Hospital on the right eye an operation for cataract extraction with vision + 10.00 spherical 15/xxx and with + 15.00 Smellin 0.50 June 13, 1917, vision reduced to counting of fingers at eleven feet and he is no longer capable of reading his newspaper. He was given iodide of potash, but by March 27th he counted fingers at but seven feet. Ophthalmoscopic examination: vitreous hazy and fundus obscured. Eyeball not injected. Patient has a low grade of choroiditis. Left eye cataracta matura with very poor light projection. He has suffered much from rheumatism, but has refused to have the dentist extract his remaining six or seven teeth, all of which are diseased. Early in April, 1919, he was prevailed upon to see his dentist, who removed six "snags," as the patient designated them to me. The right eye gradually began to regain sight and quite recently he phoned me he was again reading his newspaper. All parts of the eye may undergo disease because of focal infection in the mouth. The iris ciliary body choroid, cornea and sclera are thus affected and particularly in iritis and uveitis one must keep in mind this relationship. The etiology of oral sepsis is a broad one and embraces bad crown and bridge work, incomplete root fillings, irregular development and overcrowding of the teeth as well as lack of teeth, all of which lie in the sphere of the dentist. I am coming more and more to appreciate the importance of co-operation between the eye and throat specialist and the progressive dentist and make it a practice to get his opinion frequently where the mouth

is diseased as well as his interpretation of many radiograms embracing the teeth. Acute infection of the maxillary antrum is seen under two forms, the non-suppurative and the suppurative. We suspect the former when we see a pale oedematous swelling of the mucous membrane lining the outer wall of the nose, especially that covering the middle turbinal, where it may have the appearance of having undergone polypoid degeneration. The suppurative variety is prone to follow an acute infectious disease and the mucous membrane instead of presenting a pale edematous appearance is seen intensely congested and swollen, giving rise to obstructed breathing with maybe purulent nasal discharge. Severe facial and frontal pain may be complained of, assuming sometimes paroxysmal exacerbation with rise in temperature, swelling of the face and conjunctive, photophobia, epiphora, dimness of sight, dizziness and vertigo. Chronic disease is likewise seen under two forms, a non-suppurative and a suppurative. In the former the mucous lining of the antrum is hyperplastic, giving rise at times to polypi, especially in the region of the ostium. This form of disease not infrequently goes undetected. It is associated with repeated attacks of coryza, such persons showing marked tendency to take cold during which the chronic, watery nasal discharge, of which they complain, changes to purulency, but resuming a watery consistency after the rhinitic exacerbation has subsided. The patient with chronic suppurative disease frequently complains of a cold that does not get well, of sneezing spells and at times he detects fetor. Upon intranasal examination and after having applied a solution of cocaine and adrenalin to the two lower turbinals, so as to shrink the tissues, one may see pus coming from the region of the ostium, the flow of which is facilitated by placing the head in a position favoring gravity drainage. Suction may likewise be used for this purpose. I make use of irrigation for diagnostic purposes with normal salt solution, inserting a cannula into the ostium and failing thus to penetrate the antrum, make puncture under the inferior turbinal with a small curved trocar. The antrum may act as a reservoir for pus discharge coming from other para nasal cells, a condition we differentiate through irrigation of the antrum and walling off of the ostium by absorbent cotton; after this the patient is allowed to wait half an hour when the nose is again examined and if pus is seen we assume its origin elsewhere than in the antrum. I make use of transillumination but place far greater value on a good radiogram which gives information as to the size of the antrum as well

as the disease and the condition of the roots of the bicuspid and molar teeth.

In neoplasms we look for recurrent epistaxis, muco purulent discharge from the nose, hydrorrhea, obstructed nasal breathing, neuralgia in the teeth, face and forehead, bulging at some part of the antral wall, maybe with fistulous opening and to palpation a sensation of parchment-like crackling, spontaneous loss of teeth and cervical glandular enlargement. All forms of tumors are met with in the antrum, the small, round cell sarcoma especially being malignant, but it is my experience that the carcinoma are even more malignant than the sarcoma.

PERI-SINUS AND EPIDURAL MASTOID ABSCESS SUBSEQUENT TO INFLUENZA.

Dr. Hugh B. Blackwell, New York.

There has been comparatively little mention so far of the mastoid complications of the present influenza epidemic. The following three cases of recent occurrence have some unusual features, and present types of mastoid suppuration characteristic of influenza. In common, all of the patients were young adults and each exhibited evidences of a post aural subperiostial inflammation. In addition the operation disclosed in each patient the presence of a large peri-sinus or epidural mastoid abscess. In two instances the operations were performed upon the service of Dr. Robert Lewis at the New York Eye and Ear Infirmary.

Case 1. Female, F. K. *History.*—Three months before operation patient had suffered with influenza and pneumonia. At that time there was some subjective disturbance in the affected ear. Owing to the fact that it soon ceased, no aural examination was made. Several weeks later an abscess developed in the lung of the left side, which was successfully drained by rib resection in the mid-axillary line. Patient insisted that following her initial disturbance she had suffered no aural pain, nor had she noticed any discharge until myringotomy was performed on admission to hospital. On the day prior to admission she first observed post aural swelling and edema. Aural examination showed little if

any tenderness and a scanty discharge, smears of which showed staphylococci. Temperature 100.4° F.

Operation.—Mastoid was found to be completely disintegrated, filled with granulation tissue and pus, smears of which disclosed the presence of streptococcus capsulatus. A well developed peri-sinus abscess was revealed, beginning at the knee and extending downward for a distance of about one inch. The vein was partially collapsed and very dark in appearance. The operation was concluded and the patient made an uneventful recovery.

Case 2. Male, J. K. *History.*—Five months previously while convalescing from influenza and pneumonia the patient's left ear suddenly and without warning began to discharge. There was no previous ear ache, the discharge continued until he came to the hospital. Three days prior to admission the tissues behind the left ear began to swell. Aural examination at the time showed edema and redness of tissues over the left mastoid, slight tenderness, profuse fluctuating discharge from the canal, and marked collapse of the posterior canal wall. Temperature 98.6° F.

Operation.—On removing the mastoid cortex and subcortical cells, a large peri-sinus abscess was located lying over the vertical sinus, about three-quarters of an inch in length. Smears from the mastoid pus showed the presence of streptococci. Operation was concluded and patient's recovery was uneventful.

Case 3. Male, J. *History.*—Five weeks before operation, while convalescing from influenza, an ear ache developed which was allowed to continue for four days before a myringotomy was performed. The ear discharged more or less freely for the following two weeks, when a second myringotomy was done. About this time, patient developed symptoms of a mild attack of scarlet fever. The patient's temperature was taken at regular intervals for five weeks prior to operation and at no time did it rise above 101° F.

A swelling behind the ear was noted several days before admission. Aural examination showed a marked post aural infiltration with redness and edema of the soft parts. Profuse, fluctuating, purulent discharge was noted but little or no mastoid tenderness. There was marked sagging of the posterior superior wall of the external auditory canal.

Operation.—A large perforation was found in the mastoid cortex over the antrum region. The bone itself was completely broken down and disintegrated. After exenterating the subcortical cells, a large epidural abscess was discovered on the under surface of the dura covering the tempero-sphenoidal lobe. The epidural inflammation was localized and confined to the floor of the middle fossa.

Neither the sinus nor posterior fossa was involved. The patient's recovery was uneventful.

Summary.—In Cases 1 and 2 there was no ear ache at the time of the initial middle ear infection, and subsequently up to the time of operation Case 1 was singularly free from pain. This I attribute to lowered vitality with consequent loss of reactive ability, following the influenza and pneumonia, present in both cases. The fact that in Case 1 the canal discharge showed staphylococcus and subsequently smears from the mastoid cells streptococcus capsulatus illustrates the unreliability of canal smears as always indicating the chief infective agent in suppurations of the mastoid. Case 3 different from Cases 1 and 2, in that the abscess was confined entirely to the dura overlying the under surface of the tempero-sphenoidal lobe, there being no involvement of the dura of the sinus or posterior fossa, in other words Case 3 represents a true epidural abscess. It is interesting to note that this patient was under close observation by a trained nurse and attending physician throughout the duration of its development, his temperature was taken daily at regular intervals and at no time was there any febrile reaction above 101° F. This is the first instance in which the author has been able to observe the temperature chart of a patient for the entire period of development of an epidural abscess.

CONCLUSION.

(1) The evidences of marked local destruction in mastoiditis due to the presence of streptococcus is a significant feature of the otitic complications of influenza.

(2) In considering these cases, the latent manner of development suggests the possibility of the presence of an unsuspected peri-sinus or epidural mastoid abscess in other post influenza patients with aural disease. The importance of otological examination is clearly indicated by the histories of these patients, not only when ear ache is present, but in all cases of subjective aural disturbances accompanying and following influenza and pneumonia.

(3) Finally, when operating upon these patients, the writer wishes to emphasize the importance of leaving undisturbed protective granulations overlying the sinus or brain. All macroscopical evidences of diseased bony mastoid structure should be removed. In addition to the usual technique of the simple mastoid operation he believes in gentle curettment of the epitympanum without of course disturbing or dislocating the ossicular chain. He has practiced this procedure for a number of years when performing the simple mastoid operation with very satisfactory results.

148 West 58th Street.

RADIUM THERAPY IN TUBAL STENOSIS.*

PROFESSOR GUNNAR HOLMGREN, Stockholm, Sweden.

In the course of the last seven years there were observed in the Radium Institute of Stockholm a series of oto-laryngological cases that were sent in for radium treatment. In several of these cases radium had a strikingly favorable action and in the cases of tubal stenosis this action by radium was productive of more results than any other method employed. It might be of interest, therefore, to report the following cases:

Case I. A man 53 years of age came to the writer in 1910, complaining of a cloudy sensation in the ear, tinnitus, and difficulty in hearing. He was treated by catheterization of the Eustachian tube and after each treatment he would feel better, but on the following day the condition would relapse into its previous state. During the last month he received a daily treatment, also with transitory result. The condition was one of exudative catarrh in the left middle ear with retracted, glistening tympanic membrane, serous exudate, lowered hearing capacity, feeling of fullness, and tinnitus in the ear. The cause was easy to find. In the left part of the naso-pharynx, behind the mouth of the Eustachian tube, there was a tumor the size of a hazelnut. It was somewhat infiltrated, movable, not ulcerated. Microscopic examination of a small excised portion showed the tumor to be a sarcoma. As the patient was averse to undergoing an operation, he was given radium treatment according to the dosage recommended by Professor Forsells. After the first radium application the aural symptoms completely and definitely disappeared. Seven days after the treatment the writer examined the patient and found the tympanic membrane normal, the exudate absent, and the hearing perfect. The feeling of fullness and the tinnitus had disappeared. The tumor, however, had only slightly decreased in size. Thus the condition remained for several years, after which the patient passed from observation and died several years later, apparently from his sarcoma.

Case II. A man of 46 years of age for six months had complained of symptoms similar to the patient in Case I. He was also treated by tubal catheterization with transitory improvement, the symptoms returning usually the following day. After he had had

*From the "Acta Oto-Laryngologica." Translated by Dr. Philip Frank.

this treatment uninterruptedly for two months he came under the author's observation. He had a bilateral exudative catarrh, the exudate being noticeable through the glistening, retracted tympanic membrane. His hearing was lowered and he had a sense of fullness in the ear with tinnitus. As a cause for this condition there was an ordinary affection in the naso-pharyngeal vault. The mucous membrane on both sides of the naso-pharynx, as well as on the posterior area of the nasal septum and in the upper and outer choanal regions, was very swollen and ulcerated in certain places. A small piece of mucosa was excised for examination and the microscopic examination showed beginning sarcoma. The author was in doubt at that time, and still is, as to the correctness of this diagnosis, but he considered himself in duty bound to institute radium treatment, since the "tumor" was obviously not operable. The patient was treated in the Stockholm Radium Institute twice. The symptoms immediately disappeared completely, not only as regards the ear but as regards the naso-pharynx. The patient was again examined six and nine months later respectively and each time he was symptom free.

Case III. A man 45 years of age came under the author's observation in 1917 under similar circumstances. He had suffered for a long time from colds and tubal catarrh and had been treated without permanent result by catheterization. Examination showed a moderate rhinitis without changes in the naso-pharynx, retracted tympanic membrane, serous exudate, and lowering of hearing capacity. He was put on a strict hygienic-dietetic regime, and treated by catheterization for three weeks. At each treatment the exudate could be easily expelled, but after two days the condition would relapse to its former status. Radium treatment was recommended, and this was carried out without delay. A radium tube was placed in the mouth of the Eustachian tube in the evening and removed the following morning, the dosage being that recommended by Professor Forsells. The patient came to me in the morning entirely symptom free. Subsequent examination of the patient's ears showed them to be perfectly sound.

It is recognized that lymphoid tissue wherever it occurs in the human body is peculiarly susceptible to radium. In these cases the tubal stenosis was due to a swelling of the lymphoid tissue and the immediate subsidence of the swelling was brought about by the radium.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY.

June 6 and 7, 1919, New York City.

Retrobulbar Neuritis Due to Posterior Accessory Sinus Disease, with Report of Twelve Cases. DR. L. E. WHITE, Boston, Mass.

Dr. L. E. White, after an extensive review of the literature of the subject, detailed the cases which form the basis of the paper. Of the seventeen cases reported, two were not operated upon. In one case the eye remaind permanently blind, while in the other the patient died from sarcoma of the sphenoid bone and hypophysis.

Of the fifteen operative cases, all but one improved. In this case the eye had been practically blind for some months, and the operation was undertaken to determine what effect, if any, the opening of the sphenoid would have on the dilated veins of the fundus. Normal vision was obtained in seven cases. There was marked improvement in three cases, but some optic atrophy. In four cases there was only slight improvement. This was supposedly due to the chronic nature of the disease and the delay in operating. It is held that in all these cases an early operation would have saved much more of the vision. In seven cases the toxemia from the pus seemed to be the chief factor. Hyperplasia appeared to be the predominating lesion in eight cases. In two cases pressure apparently played the leading role. Nasal examination was negative in seven cases, X-ray findings were positive in six; negative findings, however, are by no means contraindicative of operation.

The middle turbinate was removed in all the operated cases, and the sphenoid was opened in all but one. The posterior ethmoid cell was opened as a matter of routine. Unless suspected of infection, the other ethmoid cells were not disturbed. The complete exenteration did not seem necessary in most cases. The Sluder technic of removing the middle turbinate and opening the sphenoid was followed. In practically all cases Wassermann and neurological examinations were made and the teeth investigated.

DISCUSSION.

SIR ST. CLAIR THOMSON, London, England, recalled two cases, reported thirteen years ago, in which he was able to verify, by post-mortem examination, ophthalmic and cerebral complications due to pyogenic infection of the posterior accessory sinuses.* He had been disappointed to find that nobody, so far as he knew, had followed up these observations with reports of other cases giving this definite confirmation. As the years passed he had also been disappointed at the small number of cases in which he had been able to confirm this association. The cases which had been referred to him had shown mostly orbital infections, while infection of the optic nerve and retrobulbar complications had been rather scant. He was beginning to think it was due to too much caution and to the idea that one must see pus, because, on looking back it became evident that these cases of retrobulbar neuritis had not occurred among those which

*Trans. Medical Society of London, Vol. xxix, 1906.

were streaming pus,—which anybody could diagnose,—but they occurred, as his two cases had occurred, in comparatively recent cases. He believed, with the essayist, that retrobulbar neuritis, with nothing else as a cause, called for exploratory opening of the sphenoidal sinus. He asked Dr. White if, in making the exploratory opening, the X-ray findings had proved of any help.

Dr. Harris P. Mosher, Boston, Mass., was very much disappointed because Dr. White had given no report of the microscopic findings in his series of interesting cases. The crying need was for pathology. There had been a pathology of words, but not pathology backed up by the microscope. Until such cases had been studied with the microscope they would continue to be obscure.

Dr. Eugene A. Crockett, Boston, Mass., had been surprised to see the relatively small amount of hemorrhage, and the ease with which it could be controlled, in operations upon these cases. In a case of sarcoma, operated upon by him five years ago, there was a distinct improvement of vision for nearly a year. The patient finally died from the disease, but the year's improvement in vision was well worth the operation.

Dr. Dunbar Roy, Atlanta, Ga., thought it unfortunate that Dr. White had used the term retrobulbar neuritis. Retrobulbar neuritis was dependent upon three things: (1) pressure from some extraneous condition, such as a growth, effusion, or inflammation from the cells themselves; (2) inflammation from the surrounding membrane of the nose; (3) a toxemic condition. In retrobulbar neuritis, as generally understood, there was no inflammation upon examination of the fundus of the eye. The term, therefore, was a misnomer in Dr. White's cases. The condition was more a neuritis between the eye itself and the entrance of the nerve into the orbital cavity. Retrobulbar neuritis was not a very common condition. In twenty-five thousand cases which he had examined there had been only twenty cases of this condition. Dr. White had seen all of his cases within three years, which, in the speaker's opinion, was an enormous number of cases for the length of time. One might find all manner of inflammation around the optic nerve without involvement of the nerve itself. The term retrobulbar neuritis should be changed. It was manifested in the very beginning by central scotoma. There might be absolute blindness, but whether it would lead to optic nerve blindness was a question. It was very difficult for the optic nerve to become involved.

Nose and throat men were getting to be extreme in the idea that all these conditions were due to sinus trouble. He had had a case, with typical symptoms of retrobulbar neuritis, which gradually progressed toward recovery, yet when he examined the nose he found what seemed to be a hyperplastic condition of the middle turbinate. He did not remove it, but the patient got well. It was an error to think that all cases of retrobulbar neuritis are due to disease of the middle turbinate and to remove this structure. A halt should be called in the indiscriminate opening up of the turbinate simply on suspicion. Many other factors might give rise to retrobulbar neuritis without involvement of the nerve itself. Noteworthy among these factors might be mentioned toxemia from the alimentary canal. In many cases it was due to pressure, and removal of this would

relieve the symptoms. It was difficult to injure the optic nerve, and a large proportion of the cases of optic neuritis were traceable to disturbance of the vascular supply of the nerve itself. In many of these cases reopening the themoid cells merely resulted in injury. The main point was that the condition was not a retrobulbar neuritis but optic neuritis. Dr. White had referred to papillitis; in retrobulbar neuritis there was no inflammatory condition no tortuosity of the blood vessels, no chocked disc. Chocked disc occurred with retrobulbar neuritis. A more careful consideration of the term would be advantageous.

Dr. J. W. Jervey, Greenville, S. C., like the preceding speaker, was both ophthalmologist and rhinologist, and wished to endorse what Dr. Roy had said. The only symptoms of retrobulbar neuritis were blindness and central scotoma. While Dr. White's paper was an interesting and extremely valuable contribution, it must be remembered that these cases fall into the hands of the ophthalmologist first, and he should be impressed with the importance of understanding the etiology of the disease and not waiting for the appearance of accessory sinus disease to suggest the condition.

Dr. William H. Haskin, New York City, referred to his observations, published several years ago, on the relationship of the sphenoidal nerve to the ethmoid and other sinuses. The more of these reports he had heard the more he had become convinced that disturbance of the optic nerve was not a disturbance of the nerve itself but of the sympathetic cavernous plexus. All sorts of relationships were possible there, as he had shown. Inflammation of the sympathetic nerve would give the same symptoms physiologically as inflammation of various others. These are invariably vasomotor disturbances. The trouble, in these cases, was traceable to sympathetic nerve disturbances. In old chronic cases there had been a depression of its sympathetic control, but the trophic nerve, which is also sympathetic, had been so disturbed that a trophic condition arose.

Dr. Mosher added that he hoped the members had understood Dr. Beck's concise and simple explanation of the pathology. His own remarks had been reinforced by what Dr. Beck had said.

Dr. White, in closing the discussion, said the X-ray had been used with benefit in seven cases. One should not depend too much upon the X-ray findings. When negative he went ahead just the same; he merely felt a little safer in making the exploration, after inspecting the plates.

Dr. Mosher was reminded that, in reading the paper, it was necessary to omit a great deal of the discussion on the pathological aspects of these cases. Jonathan Wright had done considerable work along this line for Dr. Sluder. The findings under the microscope, however, were rather meager. Not much reliance could be placed upon the pathological findings. The clinical findings made it necessary to operate.

He had felt uncertain as to the title of the paper. He knew perfectly well the typical symptoms of ordinary retrobulbar neuritis. He had talked it over with Dr. Quackenbos, who thought the term retrobulbar neuritis was used in such way that it was about the only one word that could be employed to describe the condition. If Dr. Roy or anybody else could suggest a better name he would be very glad.

The large number of cases for the length of time was accounted for by the fact that in the clinic where most of the cases occurred he saw a very large number of patients. In each case the patient had been examined and referred by a competent ophthalmologist. Of the seventeen cases seen, ten had gone on to partial atrophy before he examined them. He did not think it safe to let these cases go on without operation. They would have benefited if they had been operated on immediately. The operation was not dangerous; it was a dreadful thing to be blind.

Dr. Haskin's remarks about the sympathetic nerve were interesting and valuable.

Experimental Observations on Brain Abscess. DR. JOHN J. MCCOY, New York City.

Dr. John J. McCoy detailed experiments which were conducted in the search for a safer and more reliable method of scaling off the meningeal membrane at the point of drainage through the dural incision, so as to prevent the general infection of the meninges and consequent fatality which so often ensues in cases of brain abscess following middle ear and mastoid infections. The methods chiefly employed for this protection are: (1) that advocated by MacEwen, which calls for the packing of a layer of gauze around the margins of the dural exposure, between the bone and the dura; (2) that known as the Cofferdam Dressing, in which the dura is incised crucially at the elected point of exposure and iodoform gauze packed beneath the dural flaps, in the hope of causing adhesions to form at the site of the packing.

In the experiments detailed a number of procedures were tried for the purpose of forming a safety zone through which to operate. All experiments were executed with the animal under anesthesia. A skin incision was made, followed by the removal of a section of the bony cortex, and exposure of the dura for an area of about one and one-half inches in diameter. The dog, in each case, was killed after a stated interval, the brain was perfused with saline solution and formalin, and sections made for microscopical examination of the treated dura, pia, and adjacent brain tissues. The following experiments, in turn, were made: (1) Mildly cauterizing the dura. (2) Subdural injections of paraffin (melting point, 110). (3) Subdural injections of paraffin mixed with iodin. (4) Subdural injections of bismuth paste. (5) Subdural injections of one-half strength tincture of iodin (diluted with water). (6) Subdural injections of iodinized paraffin. (7) Subdural injections of paraffin and iodoform powder. (8) Subdural injections of paraffin mixed with yellow oxid of mercury. (9) Gauze packed between bone and dura at margin of exposure. (10) Subdural injections of paraffin and closure of wound.

It was then proposed to infect the dura within the safety zone made by the adhesions brought about by the method which gave the best adhesions. Accordingly, virulent cultures of streptococcus and staphylococcus were used. In a series of twelve dogs meningitis failed to result, either in the treated or untreated animals. Finally, 4 c.c. of broth culture of streptococcus hemolyticus, injected into the femoral vein of a dog, failed to give a blood culture in twenty-four hours.

From these experiments it is concluded that subdural injections of paraffin give a better type of adhesions than gauze pressure, because more accurate, and that such injections do not seem to produce cerebral irritation.

DISCUSSION.

DR. EDWARD B. DENCH, New York City, commended the valuable experimental work done by Dr. McCoy and Dr. Eagleton. Dr. McCoy's work had brought out the advantages of the method of Ballance in the matter of adhesions. This was of great practical value.

He agreed with Dr. Eagleton regarding the danger of too much manipulation. He was sure he had lost a number of cases in the earlier days of his practice by trying to clean out every part of the cavity. In encapsulated cases one must clean out the cavity. In a good many cases seen in the early stages there was not a firm capsule, only a limiting membrane. In these cases too much manipulation was dangerous. McEwen, who had the best results, did the least manipulation. He simply opened the cavity, put in a drain, and the cases recovered. The speaker agreed with Dr. Eagleton that the capsule must be removed if present. In a large majority of encapsulated cases the capsule was very thick. The normal intracranial pressure crowded out the pus after the capsule had been excised, and there was a tendency for the abscess cavity to collapse. Circumstances were most favorable for drainage when the opening was made at the most dependent portion of the abscess. It was not always possible to drain at the most dependent portion. The fact, as stated by Dr. Eagleton, that the cases most apt to be cured are those which are drained through the tympanic roof, was explained in part on the basis of there being less reason for secondary meningitis. Dr. Eagleton's point about not losing the abscess was well taken. The speaker did not use an encephaloscope, but had found that two very thin retractors, passed along a director, could be employed without damage to the brain. By inserting and then separating these retractors, complete drainage of an abscess could be secured. He had found the retractors more satisfactory than the encephaloscope. Dr. Eagleton's instrument was very ingenious.

DR. EUGENE A. CROCKETT, Boston, Mass., held that the question of the recovery from brain abscess operations was really dependent not so much upon the surgery as upon the preliminary diagnosis. In his experience, cases recovered when there was not unnecessary mauling of the tissues. Where it was necessary to explore the brain in the search for the abscess the mortality was very high, because of the injury to the brain tissue. Dr. McCoy had said the common cause of the fatality is secondary meningitis; in the speaker's experience secondary meningitis was relatively rare. Unless one caused a great deal of injury to the brain tissue in the exploration the meninges were not likely to be infected to any great extent. He agreed with Dr. Dench that the first and most important point was to do just as little manipulation as possible, to get through as rapidly as possible, and with as little injury to brain tissue as possible, especially in cases with no limiting membrane. The making of too small an opening was deprecated. An incision a quarter or a half inch long might fail to reveal an abscess which a little larger exposure would have instantly

revealed. That was the commonest source of error which he had observed in the past. The essentials to success were, first, a large opening of the skull; second, a very limited amount of exploration of the brain; third, a small amount of handling of brain tissue, and no attempt at curetting out the abscess cavity by any method. Whether one walled off the dura or did not wall it off at all was a secondary matter.

DR. JOHN W. MURPHY, Cincinnati, Ohio, emphasized the importance of the point concerning the mauling of the tissues. The less the handling of the brain tissue the better the prognosis. Inasmuch as in the majority of these cases which he had encountered the brain abscess had had its origin in suppurating ear disease, he had preferred to go up through the tegmen tympani, hunting for the abscess from that direction. When found, it was most easily drained through the egmen tympani route. In searching for the abscess he had had the best results with the Graefe knife. When an encapsulated abscess was encountered one could tell it by the sense of resistance. As soon as pus was discovered he passed in a hemostat and evacuated the cavity, never removing the hemostat, thus preventing the collapse of the cavity. He always preferred to have a neurologist present to assist in the locating of the abscess. Very frequently the patient might have all the symptoms of brain abscess, and yet no abscess be found. He cited a case in which there had been a discharging ear for six weeks. The neurologist insisted that there was a brain abscess. After removing a considerable amount of necrotic bone he was inclined to stop, in view of the fact that he had had several cases in which the symptoms disappeared after the removal of necrotic bone. The neurologist, however, insisted on proceeding with the operation. With the Graefe knife he made exploratory incisions in several directions. No pus was found. The patient recovered, without a single bad symptom. Aside from the extensive exploration, he felt sure that part of the good result was due to the use of the thin knife instead of the searcher.

DR. FERDINAND LEMAITRE, Paris, France, discussing Dr. Eagleton's paper, said: "I am especially interested in the question of the treatment of abscess of the brain, upon which subject I have just read a report to the French Oto-Rhino-Laryngological Congress, held in Paris the 12th of last May.

"My work is based upon eighteen observations, six of which were cases of encephalic abscess of auricular origin (four of the brain resulting in cure, and two of the cerebellum, of which one was cured and the other was being cured when death resulted from a second abscess). The other twelve observations pertain to encephalic abscesses or foreign bodies, following wounds.

"The principle of my method consists in accomplishing what I call the 'exclusion of sub-arachnoid space,' by analogy with the exclusion from the large peritoneal cavity which is observed in the course of certain appendicitis cases.

"This exclusion is accomplished in the following manner: In no case and under no pretext do I cut the meninges; in no case and under no pretext do I use a bistoury. With a fine Pravez needle I work the meninges and the encephalus at the assumed location of the abscess. When the pus comes out through the outer opening in the needle, I replace the

latter by a grooved probe, along the groove of which the pus flows. Then I introduce into the very small orifice of the meningeal gap (with the aid of a very small bent otologist's forceps) a tiny rubber drain, one millimeter in diameter.

"Now, *around this drain adhesions form very rapidly;* they transform the meninges into a fibrous ring and this accomplishes the process of 'exclusion.' Every day for five or six days, I change the drain, using larger ones progressively (three, five, seven and nine millimeters in diameter). I obtain in this manner a meningeal-encephalic canal by which the drainage is accomplished very easily, and by which an encephaloscope can be introduced. The encephaloscope has enabled me, in traumatic lesions of war, to remove, checked by the eye, sequestra, and twice projectiles (shell splinters).

"The exclusion of the meninges is accomplished very easily; it permits the avoidance of, first, meningitis, in creating a fibrous barrier between the sub-arachnoid spaces and the drainage canal; second, encephalic rupture, since the brain or the cerebellum find before them, instead of the opening of an incision, a barrier, and a reinforced one.

"This method of 'exclusion of sub-arachnoid spaces,' seems to me to modify considerably the prognosis of the treatment of encephalic abscess of otitic origin, and in a more general way encephalic surgery."

DR. LEE WALLACE DEAN, Iowa City, Iowa, held that the prognosis of brain abscess depended upon the extent to which nature had erected a barrier against infection, and the amount of manipulation of brain tissue at the time of the operation. He had in mind two types of brain abscess in which with an operative procedure which is *nil* so far as the brain is concerned, very satisfactory results could be secured. The first type was that which followed the penetration of the dura by a spicule of bone, the result of a fracture of the temporal bone. This type of cases he had seen weeks or months after the accident. The only treatment which he had considered advisable, was the removal of the depressed piece of bone, and the insertion of a cigarette drain through the opening in the dura, the application of hot compresses. Following the removal of the piece of bone, pus would exude from the opening, and around this would be found adhesions. A few days of drainage with the cigarette drain and hot compresses, produce a very good result. The second type of cases was one where nature had produced a discharging sinus through the dura. Frequently the pus discharged through the mastoid, tympanum, and external canal. In this type of cases he felt that the less manipulation the better. The insertion of a soft cigarette drain, together with hot compresses, would bring about very satisfactory results.

DR. JOHN F. BARNHILL, Indianoplis, Ind., thought it had been well said that over-manipulation kills the patient with the brain abscess. It had been reasonably well settled that these cases should not be mauled and handled until the operator was more responsible for the patient's death than the abscess. It was necessary to secure adequate drainage in a situation where it could maintain itself, but in all cases of otitic abscess no other operation was justifiable except one which goes through the tegmen tympani or tympanic antrum. A large bone flap should be turned down, so that the abscess could be found with ease. This was better than depending

upon a rather small trephine opening. He had always used through and through drainage. He was sure that Dr. Eagleton had seen cases in which the abscess wall was too thick to be collapsed and obliterated in the way which he described. In this class of cases Krause had recommended the dissection of the limiting wall. He did not agree with this.

In connection with Dr. McCoy's paper the speaker referred to his own efforts toward infecting the dura of the dog. Some years ago he had presented a paper detailing his attempts to infect the lateral sinus of the dog. He had found it almost impossible to do so, despite the fact that he dropped the needles with which he punctured the dura on the floor, rubbed them in the filth and dirt of the dissecting room, and resorted to other measures tending to cause infection. These experiments had led him to wonder whether the dog is not more resistant to infection than other animals.

Dr. John W. Murphy, Cincinnati, Ohio, added, with reference to the point about introducing a hemostat, that if there were no capsule the hemostat would go in, whereas if there were a capsule, it would not. He had treated forty-eight cases of abscess, largely traumatic. In traumatic abscess there was good chance of recovery, because there was a tract which could be entered without infecting the meninges. Puncturing through an infected area means killing the patient. If one punctured through a clean area and found nothing, very little harm was done so far as meningeal infection was concerned. Exploring the brain was not fraught with danger providing the exploration be made through a clean area.

Nasal Sinus Disease in Infants and Young Children. Dr. Lee Wallace Dean, Iowa City, Iowa.

Dr. Lee Wallace Dean found, among the conditions which may be associated with nasal sinus disease in infants and young children, and which may be improved by treatment of the sinus trouble, the following: multiple arthritis; imperfect healing and bad results in posterior cleft-palate operations; tendency to develop a temperature of 101. with evidence of respiratory infection without apparent cause; necrosis of ethmoids (revealed post-mortem); cyclic vomiting; nasal discharge; sphenoid empyema; nephritis; headache; neuralgia of the fifth nerve; neurotrophic disturbances; chorea; pulmonary infections; laryngitis.

All of the cases observed were referred, and in each instance a pediatrist or orthopedic surgeon, or both, assisted in the handling of the case.

In all cases of arthritis in infants and young children studied during the last eighteen months, the source of infection was found to be in the upper respiratory tract, in the nasal sinuses, faucial or pharyngeal tonsils. In no case were the teeth the source of the infection, or the gall bladder, or the appendix. It was not to be inferred that these sources of infection should be excluded; it was merely felt that the series of cases studied indicated the necessity of continued search in the nose and throat.

Having determined, by X-ray or otherwise, the presence, size, etc., of sinuses, the diagnosis of sinus disease was still difficult to make. It was only by repeated examinations of the nose, careful study of the case from every angle, that a proper diagnosis could be made. Bacteriological investigation of the sinuses was important.

The most important feature of the treatment of nasal sinus disease in infants and young children is the removal of adenoids and diseased tonsils.

Up to July 1, 1918, the sinuses of 234 children, thirteen years of age or younger, suffering from adenoids, had been examined. Many of them had chronic tonsillitis. In 15 per cent of these cases infection of one or more sinuses was found. The sinus infections were not treated. The tonsils and adenoids were removed and the patients asked to return in four or six weeks for examination. Only seven cases returned for examination. Five out of the seven were found to be apparently free of sinus disease, the disappearance of the sinus disease being due to the removal of the tonsils and adenoids.

Since July 1, 1918, the sinuses of 145 cases with adenoids, or with adenoids and chronic tonsillitis, had been examined, of which number 65 had some definite sinus disease, in many instances the infection being exceedingly mild, in others very virulent.

In studying the bacteriology of these cases it was found practicable to concentrate attention upon the antra because, with the exception of the ethmoid cells, the antra were the most frequently diseased and the most uniformly developed in young children, and of all the nasal accessory sinuses, they are the most easily accessible.

The washings from the antra varied from perfectly clear fluid without any trace of cloudiness, to thick white pus which could be drawn through the aspirating needle only with difficulty. In some instances the washings contained varying amounts of clear, glairy mucus, which, on microscopic examination was found to contain no puss cells. In still other cases the antra contained both mucus and pus. Of the 54 apparently normal sinuses examined, pus was found in but two cases and mucus in eight.

There were fifty-five cases altogether in which, prior to the antra puncture, there was reason, either systemic or local, for suspecting nasal sinusitis. Of these, only two, or less than 4 per cent, had pus in the antral washings; eight, or approximately 15 per cent, had clear mucus in the washings, and forty-four, or 80 per cent, had neither pus nor mucus. In these cases there was a very close similarity between the macroscopic and the cultural findings, thirty-nine, or 70+ per cent of the fifty-five cases being sterile, three, or 5+ per cent, containing a hemolytic streptococcus, and 24 per cent containing organisms other than hemalytic streptococci.

Forty-three cases gave no definite evidence of sinusitis before the taking of X-ray plates, when one or more sinuses were fund to be blurred. The washings of the antra showed no mucus in 58 per cent. Mucus was present in the washings in 24 per cent, and in 18 per cent pus was found. The cultural results were in close accord with the macroscopic results of the antral washings: 55 per cent of the cultures were sterile, 4.6 per cent contained hemolytic streptococci, and the other 40 per cent contained various organisms such as are found in the nares.

Of the 98 cases comprising these two groups, cultural tests showed that bacteria were present in the antra in 35 cases. Of this number, the staphylococcus was found in 45, the pneumococcus in 13, unidentified gram negative bacilli in 8, diphtheroid bacilli in 7, micrococcus catarrhalis

in 7, hemolytic streptococcus in 5, staphyloccocus viridans in 1, and Friedlander's bacillius in 2.

DISCUSSION.

DR. ROSS HALL SKILLERN, Philadelphia, Pa., ventured that thoughtful reflection, in the quiet of one's study, at the close of the day, if among one's patients had been an infant or young child, was apt to bring an uneasy conscience. Not that any grave errors of omission or commission had been committeed, but rather that one may have taken too much for granted. One was apt to overlook the old adage that negative findings prove nothing. All were well aware, of course, of the peculiar difficulties attending the examination and treatment of very young children. He had not made the systematic examination of the sinuses under general anesthesia, before operating for the removal of tonsils, and adenoids, as suggested by Dr. Dean. It was not always practicable to do so, and, indeed, the idea had not occurred to him, but it was well worth remembering. He had always put the child on the back, allowing a few drops of a weak cocain solution to trickle back, through the nostrils, then making the examination. In the endeavor to use the nasopharyngoscope the child's determination not to be examined would often get the better of the examiner's patience.

One could easily see how a small infection in the nose of an infant might lead to disastrous consequences, and therefore the tremendous responsibility and importance of trying to ferret out such foci, as shown in Dr. Dean's paper.

The bacteriological work detailed by Dr. Dean represented a new departure, so that any discussion, on that portion of the speaker's paper, would be merely academic. He had read the paper not once, but four or five times, and was sure that merely listening to a paper of this kind did not give an adequate idea of its importance. The paper represented an enormous amount of new and important work.

DR. LOUIS K. GUGGENHEIM, St. Louis, Mo., had observed, not infrequently, in children, the distinct appearance of pus in the middle meatus, sometimes on one side, sometimes on both. In many cases the infection was due not to sinus infection but to adenoid suppuration, and by capillary attraction the pus had been drawn forward into the nose. If distinct disease of the antrum existed, removal of the adenoids would not bring about immediate cure, as it would in many of these cases. Distinct chronic sinus infection would not clear up so rapidly after removal of adenoids and tonsils. He had proved to his own satisfaction that many of the cases diagnosed as sinus disease were adenoid infections.

DR. WILLIAM B. CHAMBERLAIN, Cleveland, Ohio, could not share Dr. Dean's feelings with regard to the ease of diagnosis and treatment in the class of cases under discussion. The antrum of Highmore was easy to deal with, but sinusitis, in the ethmoid or the sphenoid, presented decided difficulties, in his experience. The field was narrow, and one was confronted by an especially difficult problem; one was between Scylla and Charybdis. If one overlooked the sinusitis, one was in serious trouble; if one tried to go in and clear out the infection, he might encounter serious difficulties. He cited a case of unilateral discharge in a child three years of age, in which he made an examination, finding a large mass in

the nasopharynx. He thought the obstruction in the nose might be due to a foreign body, but it was due to a large adenoid mass whose size was markedly increased by polypoid degeneration of adenoid tissue.

He asked Dr. Dean, in closing the discussion, to elaborate the questions of diagnosis and treatment. He thought the treatment as difficult as the diagnosis.

DR. JOHN J. MCCOY, New York City, called attention to the interrelationship of sinusitis, defective drainage, swelling of the mucous membrane, and systemic infection. Improvement in many of these cases was due to relief of the sinus infection. During the last eight years he had seen two cases of brain abscess in children. Neumann, of Vienna, who was in Washington when the speaker read a paper on the subject, asked what about the bacteriology. When told that the pneumococcus was the infective organism, he said the pneumococcus was always present in brain abscesses in children. The speaker asked if any of those present had seen brain abscess following accessory sinus disease in children. One of his cases had died. There was a tremendous swelling on Friday, and on Sunday, in opening up the sinus on each side he found a large epidural abscess on one side. After drainage the child did well for a few weeks, then had contralateral paralysis. On opening the frontal lobe a cupful of pus came out. In the other case there was frontal sinus disease. There had been swelling in the frontal region. Symptoms of brain abscess in the frontal lobe developed. This was opened, but the patient went from bad to worse. He then made an opening in the side, with free drainage from the front to the side, and recovery followed.

DR. DEAN, in closing the discussion, said he appreciated very much Dr. Skillern's remarks. Both he and Dr. Armstrong considered Dr. Skillern an authority along the lines of pathology and bacteriology of sinus disease. In writing the paper he had tried to avoid making definite diagnoses, but rather to state the findings and let one draw one's own conclusion. He would want to have a good deal more investigation of the subject made before he would come to any definite conclusion as to the exact method in which these adenoids and tonsils cause sinus infection in infants and young children.

Sarcoma of the Nasopharynx. DR. DUNBAR ROY, Atlanta, Ga.

Dr. Dunbar Roy reviewed the literature of this subject from 1898 to date. From this it was noted, with regard to treatment, that good results have been obtained by the use of the X-rays and radium, especially the latter. The writer believed that radium treatment is still in its infancy, and that the next few years will show the reports of many cases of malignant growths of the nose and nasopharynx which have yielded to this mysterious remedy in a manner far superior to all other known methods of treatment, especially the so-called operative procedures.

In the case which formed the basis of the paper, after the clinical diagnosis of sarcoma of the nasal cavity and nasophaynx was made, the use of radium was advised immediately, in view of the previous experiences with operative treatment in cases of this class. A tube containing 10 milligrams of radium was placed immediately against the growth, through the nasal cavity, and allowed to remain one hour. This was repeated

every fifth day, until four applications had been made. No improvement was noted, the growth increased, the ethmoid on the left side having become involved, and the patient was sent to Dr. Kelly, in Baltimore. The growth was reported to be small round-celled sarcoma. Radium was employed by Dr. Kelly for four months. An office examination, after the patient's return, showed that the growth in the nasopharynx had been reduced at least two-thirds. The patient returned to her home in another city, expecting to take the radium treatment later, but her condition gradually became more serious, and she died two months later from general sarcomatous toxemia. Better results probably would have been obtained had not the growth penetrated into the vascular region of the ethmoid cells. The partial disappearance of the nasopharyngeal portion of the growth under the influence of radium was considered remarkable. Early recognition of malignant growths in the nasopharynx and the early application of large doses of radium offers the best chance of cure, and, to the writer's mind, is the rational method of handling these cases.

Sarcoma of Right Tonsillar Fossa. DR. WILLIAM C. BANE, Denver, Colo.

Dr. William C. Bane reported a case of large round-celled sarcoma of the pharynx in a boy thirteen years of age. Inasmuch as the patient, who had been referred to Dr. Bane on account of pain in the right ear, presented the typical facies of peritonsillar abscess, he was given a general anesthetic and a search was made for a pocket of pus external to the right tonsil. The dissection was extended until the tonsil was enucleated, and a free opening was made with forceps into the swollen retropharyngeal tissues. No pus was found. The swelling in the right side of the pharynx increased after this operation, being suggestive, on inspection and palpation, of abscess. Only blood and serum was evacuated upon opening. Inasmuch as malignancy was not suspected, the tonsil was not saved for microscopic study.

Antistreptococcic serum, in addition to tonics and stimulants, and other adjuvant measures, seemed to cause some decrease of the infiltration in the tissues. Dyspnea and dysphagia increased during the next four months, and finally the mass in the pharynx was perforated again. Only a slight amount of blood and serum escaped. A small piece of this mass was excised for microscopic diagnosis.

The patient, after about three months, was sent to a radium laboratory, where he was given two treatments. Marked relief followed the first application, and there was a decided shrinkage of the enlargement in the pharynx. The improvement was only transient, however.

DISCUSSION.

DR. THOMAS J. HARRIS, New York City, said the question of malignant disease of the upper respiratory tract was an oft-recurring subject of discussion, and always would be so long as efforts at understanding the cause of the disease were unsuccessful and the profession remained ignorant of the cure. He had read Dr. Bane's paper and had been familiar with Dr. Roy's work, but he was surprised to know of the amount of literature on the subject. He recalled having heard Jonathan Wright say that it was not an uncommon experience to have these cases run in groups. The speaker had had six cases a few years ago, but since that

time he had had none. He had failed utterly with radium in the treatment of sarcoma of the nasopharynx. Dr. Freudenthal would doubtless recall a case seen in consultation with the speaker some years ago, in which radium failed eventually. This did not apply to benign growths of the larynx. He agreed with Dr. Smith with regard to sarcoma of the tonsils.

He wished to called attention, without in any sense advocating it, to the theory of Dr. L. Duncan Bulkley, of New York, who had contended for years that the surgeon was working at the wrong end, that the surgeon was too prone to use the knife, and that he was merely removing the result of an abnormal process in the body and not the disease itself. Dr. Bulkley had reported remarkable results by means of treatment directed toward the removal of toxins from the alimentary canal. The speaker cited a case of epithelioma of the tongue in which the ulcer had been completely held in check, not by surgical operation or other treatment, but by directing attention to the pronounced intestinal toxemia. He was inclined to believe that hope would be found along this line rather than through surgery or radium.

He had one case in which good results were obtained from the use of Coley's fluid.

Dr. Wolff Freudenthal, New York City, was glad to hear that Dr. Roy had depended upon his own clinical diagnosis. The injection af salvarsan would do harm, but that was all. He had had one series of cases in which every patient died. He had been able to keep patients alive longer by means of radium than by any other method of treatment, but everyone of these patient died, too. These were cases of nasopharyngeal sarcoma. It was different with sarcomata of the tonsils. He had seen quite a number of these cases. Two were cured, one lived eight years after the commencement of the treatment. After eight years erysipelas developed and the patient died. This was peculiar, in view of the contention that infection with the germs of erysipelas had a curative effect on sarcoma. For all he knew, his next fifty cases might all die, nevertheless he considered radium the best means of treatment at the present time. He mentioned, in this connection, a paper which he had read in a Spanish journal, by Dr. Botey, of Barcelona, who recommended radium in carcinoma of the larynx, applied by means of an intubation tube, in which he placed the radium. It was used with or without tracheotomy.

Dr. Harris P. Mosher, Boston, Mass., thought the first two speakers, Dr. Smith and Dr. Harris, had left a pessimistic impression regarding sarcoma of the accessory sinuses. He shared their ideas to a certain extent, but was pleased to hear Dr. Freudenthal give a ray of hope. Referring to the remarks of the first two speakers with regard to the surgical treatment of these cases, he emphasized the point that the man who operated should be familiar with the use of the headlight and he should know the anatomy of the accessory sinuses. If the cases were seen early, and a thorough operation performed, and if a liberal incision were made in the cheek, Moure's incision preferably, and if the opening in the cheek were left, and radium used often and thoroughly, a few cases might be saved.

Dr. Joseph A. White, Richmond, Va., mentioned a case which he thought quite remarkable. When he called Dr. John Dunn to see the woman and

told him she had been under treatment for thirteen years the patient promptly corrected him with the statement that he had been treating her for twenty-three years. She was seventy-three years of age at the time. When he first saw her he found a smooth growth blocking the right nostril. It seemed impossible to pass a snare around it, but succeeded in removing a piece for examination. This proved to be spindle-celled sarcoma. In about eight months the patient returned with a recurrence, which again completely blocked the nose. He used the galvano-cautery this time. Two or three times a year since that time he has used the galvano-cautery. The swelling was reduced, the nose opened and the patient apparently became comfortable after each treatment. However, the nose would soon become blocked again and she would return for another treatment. About five months ago when she returned he found that there was an external projection, showing that the growth had apparently invaded the antrum cavity.

The galvano-cautery was used as before, but more vigorously. In twelve to eighteen hours the reaction resulted in great swelling of the eyelids, with redness, and projection of the eye, all the symptoms apparently of acute orbital cellulitis, but there was no pain. The sight of the eye, however, was almost abolished, having only perception of light. Dr. Dunn and the speaker examined the eye, finding optic neuritis, with slight evidence of thrombosis. The patient was kept in the hospital two weeks, during which time the condition progressed to blindness in the affected eye. The enormous swelling and pressure produced by the use of the galvano-cautery, with probable thrombosis, had caused atrophy. There was no doubt as to the character of the growth, several pieces removed from time to time having been found to be large spindle-celled sarcoma, yet the patient had lived for more than twenty years, and was perfectly well in all other respects. In view of this experience he would recommend the galvano-cautery, especially in cases where operation was refused, as in this case.

Dr. John F. Barnhill, Indianapolis, Ind., spoke in favor of the surgical side of the treatment of these cases. The discussion had drifted away from the subject of the papers, although Dr. Roy had mentioned extension to the sinuses. Few diseases had been prognosticated upon less favorably than sarcoma of the tonsil. This was not at all true of the accessory sinus system. Treatment of sarcoma of the sinuses had been in the situation of the man "between the devil and the deep blue sea," the devil representing the general profession and the deep sea the surgeon. Two years ago he had read a papér on this subject before the American Laryngological Association in which he stated the position to which he adhered at the present time, namely, that the work of the special surgeon had been short of what it should be, while the general surgeon, on the other hand, did not see these cases until so extensive an operation was necessary that the patient would not submit. Sarcoma of the jaw and hard palate often recovered when subjected sufficiently early to radical operation. This applied to cases which were clearly sarcomatous. He recalled such a case, which occurred after injury. Examination revealed that it was sarcoma of the round-celled variety. The patient, a young girl, was alive after seven years. Early diagnosis and early radical surgery were the points to be emphasized.

Radium had been a failure in all cases in which the speaker had seen it employed. He had yet to see a case of sarcoma in the neck or in the sinuses benefited by radium. In epithelial and superficial malignancy it did good, but not in deep-seated glandular growths.

The block dissection of the tissues had been proposed, and he had tried the method in a few cases of sarcoma of the tonsil.

DR. JOHN O. MCREYNOLDS, Dallas, Texas, had seen very large tumors disappear rapidly under the application of radium, but all had recurred. Radium should be given a trial in the early stages of the disease, before the condition had become inoperable. Unless a surgeon had the ability to remove every particle of the malignant tissue he should not operate. This point was well illustrated in several cases of melanosarcoma of the choroid, in which it was possible to remove absolutely all of the growth, and in which there were no recurrences. Unless this could be done the case might just as well be left alone.

Possible variations in degree of malignancy were always to be borne in mind. He recalled a case, presenting all the clinical, macroscopic and microscopic evidences of sarcoma of the nose, in which nothing was done for seventeen years, and yet the growth did not advance to fatal conclusion during this period of observation.

DR. JOHN J. MCCOY, New York City, held that in all cases of malignant disease surgery offered the best hope, if taken early; radium next. For six months he had been watching the work of the General Memorial Hospital, where they did not rest with the application of radium on the surface, but injected the radium into the growth. The radium was kept in a large safe, out of which came tubes, more and more finely graduated, until they could be broken off half an inch in length and one-twentieth of an inch in diameter. These tubes were broken off and placed in the needle, which was plunged into the center of the growth. They had gotten wonderful results in cancer of the tongue and tonsil. He had seen growths decrease remarkably with two applications. The radium seemed to prevent the growth from spreading and to decrease its malignancy.

DR. ROY, in closing the discussion, called particular attention to the fact that he was not considering sarcoma of the antrum. He had seen cases in which the general surgeon had removed the growth and which, with the application of radium, had remained cured for years and years. But his paper dealt with sarcoma in the nose and nasopharynx. His optimism had been borne out largely by those who had discussed the paper. He hoped that radium would give the hope that had not yet been found.

The Lymph Drainage of the Accessory Nasal Sinuses. DR. W. V. MULLIN, Colorado Springs, Colo.

Dr. W. V. Mullin reported the results of an investigation, the purpose of which was to determine the course of lymphatic absorption from the antrum and frontal sinus, and, incidentally, from neighboring tissues—the nasal fossae, the palate, the gums, the meninges, and the subcutaneous tissues of the face.

A review of the literature gave little light on the subject, neither anatomists nor rhinologists seeming to have given much attention to it, such

information as they give not being well supported by experimental and clinical data.

The experiments detailed were made on living animals, and were compared with the observations of clinical cases. The experimental work consisted chiefly of injections and inoculations of the antrum in rabbits and the frontal sinus in cats, these sinuses being fairly large in the respective animals as compared with the whole skull. The anatomical arrangements are quite similar to those in man. As a rule, direct communication between the sinuses and the nasal fossae is somewhat freer than in the human subject. The lymph nodes are much less numerous than in man, and their arrangement is more constant. Those which figured in the experiments are: submaxillar, internal jugular or carotid, subparotid, postauricular, bronchial, mediastinal, faucial tonsils.

The study of the antrum began with a series of injections with India ink. The technic consisted simply in entering the antrum with a hypodermic needle, under ether anesthesia, by penetrating the skin of the face and the thin external wall of the superior maxillary bone. The fluid was then injected and the needle quickly withdrawn. After several days the animal was killed with chloroform and autopsied. In many cases the diagnosis of pigmentation—or, in the inoculated cases,—of infection—of nodes and other tissues was confirmed by microscopic sections.

Essentially the same methods were employed in the study of the frontal sinus of cats. A small hole was drilled in the frontal bone in order to enter the sinus.

From the experiments the following conclusions were drawn:

1. Lymphatic absorption from the antrum, whether of bacteria or of inert substances, is by way of the submaxillary and internal jugular nodes to the lymph ducts, the great veins, the right heart, and the lungs. Substances reaching the lungs may, of course, pass on to the left heart and the general circulation.

2. Absorption from the tissues of the face in the antrum region, and from the palate, is by the same route.

3. The subparotid and anterior mediastinal nodes may sometimes be reached by absorption from the antrum and neighboring tissues.

4. Absorption from the frontal sinus seems to follow the same course as absorption from the antrum. From the scalp over the sinus absorption usually reaches the subparotid and post-auricular nodes as well.

5. Absorption from the meninges reaches the internal jugular, probably also the submaxillary, nodes.

6. There is little, if any, absorption from the uinjured mucosa of the nasal fossae.

7. Lymphatic drainage is widely regional. Anastomosis from node to node and from side to side is free, so that it is not always possible to fix on a single node or group of nodes as the point of election for metastasis from a given region.

8. In respect of lymphatic function, as well as anatomically, the lining membrane of the nasal fossae and accessory sinuses is a continuous whole, and infection at one point can probably be conveyed by lymphatics to practically any other point.

9. There are lymphatics penetrating the posterior bony wall of the frontal sinus, and these may carry substances from the sinus to the dura over the frontal lobe of the brain under exceptional conditions of pressure in the sinus.

10. The region draining into the tonsils in these animals must be very limited, since the tonsils have not been found affected in any of the experiments, even when the palate or nasopharynx was involved.

Intra-Tracheal Injections. DR. THOMAS W. MOORE, Huntington, W. Va.

Dr. Thomas W. Moore considers that in intra-tracheal injections one has a very valuable method of treating tracheitis accompanied by cough and hawking in the morning, frequently continuing for half an hour or longer, until a small amount of mucus is expelled, after which the condition is relieved until night, when it recurs. An injection of menthol in liquid petroleum almost invariably gives relief. In asthmatic attacks more relief is afforded by a 1 per cent solution of camphor in liquid petrolatum than by novocain-adrenalin, as advocated by Bourgeois. In tuberculosis he prefers a 2 per cent guiaicol in liquid petrolatum. Menthol, guiaicol, camphor, orthoform, adernalin, and sometimes iodin, always dissolved or emulsified in some bland oil, preferably liquid petrolatum, are the medicaments which he has used.

His method involves the mirror and not direct broncoscopy or trachioscopy. Sometimes, in homes, where it is impossible to use the mirror, he has employed the method advocated by Mendel, consisting in holding the tongue out of the mouth and having the patient refrain from swallowing, the pharynx thus forming a funnel, the inferior outlet of which is the glottis, as the gullet opening is closed, so that a small amount of liquid projected against the wall of the pharynx runs down into the air passage. This is greatly facilitated if the patient will inspire at the time the liquid is introduced.

DISCUSSION.

DR. WOLFF FREUDENTHAL, New York City, was glad that Dr. Moore had mentioned the work of Dr. Horace Greene, who might easily be called the father of this method. But it was not until Coe read his paper that laryngologists began to employ the method. It was important, in treating the bronchi, to remember that substances injected do not go below the trachea. There was something that prevented foreign bodies entering the lower part of the respiratory tract, and medicines were foreign bodies. At any rate, these medications did not go down much below the bifurcation.

He had used the drugs mentioned in the paper, and had found them beneficial, but he wished to call attention to orthoform, which he had used with great satisfaction, especially the preparation which goes under his name. This was an emulsion of orthoform. He mentioned in this connection a girl whom he had treated for laryngeal tuberculosis. The ulcers healed very nicely, yet the patient came twice a week for an injection of the emulsion, which, she said, made her feel easier in the trachea. The incessant cough from the trachea in the beginning of grippe could be stopped almost immediately by injecting orthoform or guiaicol.

He believed the time would come when laryngologists would treat not only laryngeal but pulmonary tuberculosis as well, and that the results

would be just as successful in the latter disease as they had been in laryngeal affections.

Dr. H. H. Briggs, Asheville, N. C., had not employed the method suggested by the essayist. The most efficient method he had used in introducing the solution into the trachea was to place the tip of the curved cannula over and just beyond the tip of the epiglottis, resting the posterior portion of the cannula against the upper incisor teeth in order to steady the instrument. The patient was then requested to close the lips, and to take a quick, deep inhalation through the nose, at which time the solution was forced into the larynx and trachea. In that way the larynx was caught unawares, as it were, and a greater amount of the solution was drawn into the trachea than by the usual method.

He had frequently found that the patient felt the pungent effects of the medication more in the lung which contained the tubercular lesion; from the speaker by the father, who had brought his daughter, at the same might reach the alveoli.

Dr. Clifton M. Miller, Richmond, Va., had used this form of medication for sixteen years or more. The formula which he used had been given him by a tuberculosis specialist. Whether it did any good in general tuberculosis or not he did not know, but it had a wonderful effect on tuberculous ulcerations of the larynx. It burned them frightfully for the first two or three times. He did not feel that he had cured a case of ulceration of the larynx unless the man handling the lung condition had obtained a cure, but he had succeeded in giving wonderful relief with this prescription, which is as follows:

Oil of Eucalyptus, Oil of Thyme, Oil of Cinnamon, aa 15 grains. Mix and add Iodoform sufficient to saturate, then add Sterilized Olive Oil q. s. ad 100 grains. Keep in opaque bottle.

Severe and Uncontrollable Hemorrhage Following Mastoidectomy in a Patient Sufferings from Purpura. Dr. Thomas J. Harris, New York City.

Dr. Thomas J. Harris based his paper on the history of a private, under observation in the oto-laryngological service at U. S. General Hospital No. 14, Fort Oglethorpe, Ga. A history of hemophilia was elicited. While being treated for arthritis hemorrhagic spots were noted, and it was found that the gums bled easily. The diagnosis of Schoenlein's disease was made. When, about three months later, the question of operation arose because of symptoms of mastoiditis, the blood picture was studied, with the following findings: Blood count showed 16,000 white cells; differential count, small mononuclears, 4 per cent, large mononuclears, 16 per cent, transitionals, 1 per cent, and polymorphonuclears, 79 per cent. This was on November 3. On October 21 the coagulation time was ten minutes, and blood type IV; while on October 10 the clotting time was four minutes, and blood placlets 275,000.

The diagnosis of Bezold's abscess was made November 11, and operation was advised, following transfusion. Consequently, 230 c.c. of blood from a type IV donor, Wassermann negative, together with 25 c.c. of 2.5 per cent sodium citrate solution, were transfused. No reaction of any kind followed this. Thirty minutes later coagulation time was ten minutes.

On the same day the left mastoid was exenterated. Bleeding was not excessive. The next night the patient bled constantly but not profusely. Another blood transfusion, indirect, from another donor, was made. The wound oozing was controlled promptly by 5 per cent coagulin ciba. This local treatment was repeated from time to time as dressings were changed. Another transfusion was made on November 20, direct, 160 c.c., from the first donor. November 21, hemoplastin was given (5 c.c.) and coagulin applied over the wound before the application of the dressing. On November 23, and again on the 25th, hemoplastin (2 c.c.) was given. On the latter date the clotting time was seven and three-fourths minutes; on November 28, it was eight minutes. The subsequent history of the case was one of slow but complete recovery. The patient was discharged from the army, and died, in April, after a brief illness, the nature of which was apparently not recognized but was unattended by bleeding. This recalled Hess' opinion that purpuric individuals rarely live to adult life, but do not necessarily die of hemorrhage.

DISCUSSION.

Dr. John F. Barnhill, Indianapolis, Ind., had seen no such result following mastoidectomy as that described by Dr. Harris. He had had a similar experience, however, following tonsillectomy and adenoidectomy. The patient, ten years of age, the son of a physician, had been brought to the speaker by the father, who had brought his daughter, at the same time, for operation on the tonsils and adenoids. The father had made no report of any other trouble. The patients had been in the hospital over night, the tonsils and adenoids were removed in the usual way, and there was no more hemorrhage than usually occurs. About six hours later the boy began to bleed, and continued to do so despite horse serum or any other method that was used. The horse serum had no effect, neither had coagulin, fibroplastic (Squib). Transfusion was begun, first of the father's blood, which did no good, so far as could be determined, except temporarily. He found that the hemophiliac tendency had come from the father's side and not from the mother's, as usual. One hundred and fifty c.c. of the father's blood was transfused at one time, and 200 c.c. at another, no permanent relief following The mother's blood was then used, and after three transfusions of 200 c.c. each the child was in a safe condition. The case emphasized the importance of obtaining, if possible, the condition of the blood of the person acting as donor in the transfusion.

Dr. Clifton M. Miller, Richmond, Va., recalled an interesting experience he had had eight years ago, when the science of serology was not so well understood as at present. The patient, a young man seventeen years of age, had been brought to him for an exact diagnosis regarding hemorrhage which occurred, not at stated times, but when he had enough blood in his body to bleed. He was put to bed for observation. The hemorrhage seemed to come from the adenoids. Investigation of the family indicated that the tendency to bleed came from the mother's side. The coagulation time was eight minutes. The boy was very well developed physically. This condition had been manifest for about two years and a half. A direct transfusion of 150 to 200 c.c. of blood from his brother was done. The brother's coagulation time was two to three and a half

minutes. The patient's adenoids were then removed with no more trouble than one would expect. About two weeks after the operation there was another attack of bleeding, with the loss of only about a tablespoonful of blood.

In cases of apparently acquired hemophilia he had had very good results with both horse serum and thromboplastin, injecting the latter agent into the tonsillar cavity where there were apparently little bleeding points.

Dr. Thomas H. Farrell, Utica, N. Y., referring to the bugbear of anaphylaxis, cited the case of a young man who died in a few minutes from the use of horse serum for the control of hemorrhage. The patient was apparently in perfect health previous to the operation, which was not of serious moment.

Dr. Seymour Oppenheimer, New York City, said the routine examination of all patients requiring operations on the nose and throat had shown in many individuals a tendency toward a decided protraction of the bleeding time. The question of the bleeding time was far more important than that of the coagulation time. There might be a normal coagulation time and an abnormal bleeding time. He recalled a case in which the coagulation time was five minutes and the bleeding time twenty-nine minutes. In other words, many patients showed a purpuric tendency. Purpura, in his opinion, was not transmitted through families. He had recently published a report, in the *American Journal of Surgery*, of five hundred children who had been subjected, during the past two years, to tests of the bleeding and coagulation time prior to any surgical procedure. It was interesting to note the number of children who showed a protraction of the bleeding time.

He did not believe that calcium lactate had any effect whatsoever on either the coagulation or the bleeding time. Human serum was the only thing of any value. The transfusion of 10 c.c. of serum from father or mother, and the bleeding and coagulation time tested after twenty-four hours, was advocated. In some instances he had injected human serum three or four times before he had been able to modify the bleeding or coagulation time enough to warrant undertaking operation. The speaker said that he felt that most surgical work of the nose and throat was undertaken without sufficient preliminary preparation.

Dr. Harris, in closing the discussion, said it was with considerable hesitation that he had made this individual case report, to which he was as much opposed as most of the fellows of the Society, but it was done with the hope that it would drive home this question of bleeding. He had not overlooked Dr. Goldstein's report, but had disclaimed, in his paper, any attempt at going over the literature of bleeding following mastoidectomy.

He had tried to make it plain that it is important to differentiate between bleeders who are purpuric and bleeders who are hemophiliac. The distinction between coagulation time and bleeding time was also important.

He did not use hemoplastin locally, but injected it, in other words, used it internally. He was afraid of horse serum, and he could not say, with Dr. Goldstein, that where human serum failed horse serum succeeded. Dr. Hess, whom he quoted frequently in the paper, and who was one of

the best authorities in this country, felt that transfusion should not be done before the operation, because it increased rather than mitigated the bleeding. He agreed with Dr. Oppenheimer with regard to calcium lactate.

Summing up, he emphasized the points that each case should be carefully studied, that operation should be resorted to only with the greatest hesitation, that hemoplastin, thromboplastin, or other similar agents should be used, and that human and not horse serum should be employed.

Osteomyelitis of the Frontal Bone Following Frontal Sinusitis.

DR. GEORGE B. WOOD, Philadelphia, Pa.

Dr. George B. Wood discussed this subject An acute inflammatory process within the para-nasal cells is usually limited to the lining mucous membrane, and it is unusual when the periosteum is entirely destroyed, so that the inflammatory process can attack the bony structures, causing osteitis of enough severity to produce necrosis. Under certain conditions, however, such as lessened resistance, virulent infection, poor drainage, etc., necrosis of the walls of the sinuses may take place. The infective process then gains access to the neighboring structures, such as the orbit, the face, and the cranial cavity. As with the ear, the most dreaded complication of the disease of the nasal sinuses is an extension of the process to the cranial cavity. The frontal sinus is the most frequent offender in this direction, due to the fact that it presents toward the brain the whole of its internal wall. Necrotic processes of one or both walls of the frontal sinus are not so very uncommon, and quite a number of cases of consequent brain abscess and meningitis have been reported. The ethmoid cells are next in importance in the production of intracranial lesions.

Destructive lesions of the bone more frequently follow acute sinusitis than chronic. In the four cases reported the bone lesion developed within an extremely brief period of time after the first symptoms of any trouble in the sinus showed itself. The first case belonged to the class of limited bone destruction, in which the disease did not reach the diploe between the inner and outer tables of the skull and, hence, cannot be considered as real osteomyelitic cases. In Case Three it is probable that the very large uncovering of the frontal bone by the subperosteal abscess was a very important factor in the production of the necrotic process. The external table was apparently first involved, though the spread of the disease to distant parts of the frontal bone was due to the diploic infection. In Case Four access to the diploe was gained through the breaking down of the internal wall at the extreme upper limit of the frontal sinus where the two walls join at an acute angle. The breaking down of the inner table and diploe advanced to an almost unbelievable extent before there was the slightest evidence of any involvement of the external table, and it was this fact that made it practically impossible to reach the limits of the disease by operation. Another phenomenon difficult to explain was the occurrence of numerous small subperiosteal abscesses with macroscopically healthy bone beneath them, though in the latter part of the disease, the opening of these abscesses uncovered small necrotic areas of the external table. The fact that at the autopsy some of the operative openings in the skull had become almost obliterated by new bone forma-

tion, removed, to a certain extent, some of the timidity felt in removing large areas of the skull, so that in a similar case the essayist would have less hesitation in the radical removal of even suspected areas of involvement.

DISCUSSION.

DR. DUNBAR ROY, Atlanta, Ga., asked whether Wassermann tests had been made, to which the essayist replied in the affirmative, adding that the results were always negative.

Report of the Activities of the Section on Hearing and Speech, Division of Reconstruction. DR. CHARLES W. RICHARDSON, Washington, D. C.

Dr. Charles W. Richardson gave a detailed account of the activities of the Section of Defects of Hearing and Speech, Division of Physical Reconstruction, Surgeon General's office, the selection of the teachers, the formulation of a system of instruction, and a summary of patients treated and results obtained at U. S. Army General Hospital No. 11, at Cape May, N. J. On May 31, 1919, 63 patients had been discharged in the speech reading work. Of this number over 50 had completed the course. The course was completed in an average of two months.

Several patients were presented and a demonstration given of their ability to understand and to speak.

Vertigo and Aviation. DR. H. W. LYMAN, St. Louis, Mo.

Dr. H. W. Lyman emphasized the importance of the medical problems, arising in the development of aviation, in connection with the causes, behavior and correction of the disabling vertigo or dizziness experienced by aviators. The United States Air Service requires the most careful examination in all candidates for flying status of the special senses by which motion is perceived, namely, the tactile, deep muscle, visual, and vestibular mechanisms, and accepts none save those who possess a normal and complete pnysical equipment for this function. The vestibular apparatus is the most constant in its action; and, because it is a motion-sensing mechanism, pure and simple, it is one of the essential qualifications of the military aviator. Like all special senses, however, it occasionally conveys messages to the brain which, unless correctly interpreted, result in illusions. The illustration in this case is a false sensation of motion, or vertigo.

Various movements of the head have been worked out for the correction of the vertigo induced by the different stunts, and their practical value has been appreciated by the aviators instructed in them.

There is a general misconception concerning the acquirement of this so-called "vertigo tolerance," which gives the aviator the ability to control properly his ship in performing evolutions. Vertigo tolerance is the result of practice which educates the brain to interpret correctly these vertigo impulses in all planes, and is not due, as often stated, to any disappearance of vertigo because of constant flying. This has been proved by a series of experiments conducted in the Otologic Department of the Medical Research Laboratory at Mineola, L. I., the findings of which have been confirmed in the examination of a large number of fliers at various aviation fields throughout the country. In every series the falling reaction has been much less in the experienced fliers (especially those doing a

considerable amount of "stunt" flying) than in the non-fliers, while the average of the nystagmus has undergone no appreciable change in either.

By means of the "orientator" adopted by the government for use in the training of aviators, one may acquire a so-called vertigo tolerance far beyond anything he will experience in an aeroplane.

Bone Conduction in Certain Cetacea and Its Relation to Increased Bone Conduction in Human Beings. DR. JOHN D. KERNAN, JR., New York City.

Dr. John D. Kernan, Jr., presented this interesting series of observations. One of the most important symptoms of chronic middle ear catarrh is the relative and absolute increase of bone conduction found in that condition. Many of the tests on which the differential diagnosis depends, such as Weber's, Schwabach's, etc., are based upon it; yet nowhere is there agreement among otologists as to its cause. Little experimental work with a view of explaining it appears to have been done.

In making the studies on cetacea, it occurred to the essayist that in the anatomical structure of the ears of these animals might be found an explanation of the increased bone conduction of sound, at least under some circumstances.

Considering the ability of cetaceans to hear as established, he proceeded to study the anatomical structure of the ear. The material on which this study is based consists of a fetus of Kogia breviceps at term, and several specimens of Tursio tursiops for the odontocetes, and a fetus of Balaenoptera borealis, 108 c.m. long, for the mystacocetes. He had also at his disposal a considerable number of odontocete skulls. The anatomical structure of the ears of these animals is described in detail.

The auditory apparatus, typically mammalian, designed to receive air-borne sounds, is modified to one designed to receive water-borne sounds. The external meatus has been practically closed, the drum membrane fixed and the ossicles rendered immovable through fusion of the malleus to the os tympanicum. Sounds are evidently transmitted to the cochlea through the solid tissues of the head. The possibility of this is increased because in both forms the auditory bones themselves present on the surface of the skull a considerable bony process. In both, moreover, the peri-otitic and tympanic are but loosely connected to the other bones of the skull. Thus they can receive only such sound waves as impinge directly on themselves. Since the malleus is firmly fused to the tympanic it would share the vibrations of that bone, transmitting them through the other ossicles to the oval window. This is probably the explanation of hearing in cetacea, that sound waves impinging either on the tympano-mastoid in odontocetes, or the true mastoid in mystacocetes, are transmitted through the chain of ossicles to the cochlea, the endolymph being put into motion through the foot plate of the stapes as in other mammals.

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